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NUCLEAR SCIENCE ABSTRACTS

Volume 10 October 15, 1956 No. 19

GENERAL

ATOMIC POWER

8132
POSSIBILITIES OF ACTION IN THE FIELD OF NUCLEAR ENERGY. Paris, Organisation for European Economic Co-Operation, Jan. 1956. 72p.

The program necessary for cooperation between member countries in atomic energy power production is outlined. Brief descriptions are given of reactors, nuclear ship propulsion, isotope separation plants, chemical processing plants for irradiated U, heavy water production, and methods of converting U ore to metal. (F.S.)

BIOLOGY AND MEDICINE

8133
ON THE QUESTION OF POSSIBILITY OF "RADIOSYNTHESIS". S. I. Kuznetsov (Inst. of Microbiology). Mikrobiologiya 25, 195-9(1956) Mar-Apr. (In Russian)

Comparison was made of daily amount of organic substances formed during photo- and chemo-synthesis processes observed in natural conditions in a water tank with Kriss theoretical calculations of organic substances formed in a process of "radiosynthesis". Also, a comparative study was made of radioactive decay energies required for synthesis of organic substances formed from carbon dioxide with specific activity of natural waters. Considering the thermal effect of radioactive decay and the energy required for synthesis of organic substances from carbon dioxide and water it was calculated that specific activity of medium necessary for "radiosynthesis" of 0.001 mg of organic substance per 1 liter per day should be 0.0058μc. Maximal specific activity of natural waters is $50 \times 10^{-9}\mu$c which is 100,000 times below the required figure, consequently, the possibility of "radiosynthesis" should be considered impossible. (R.V.J.)

8134
POTASSIUM TRANSPORT IN DUCK RED CELLS. D. C. Tosteson and J. S. Robertson (Brookhaven National Lab., Upton, N. Y. and National Heart Inst., Bethesda, Md.). J. Cellular Comp. Physiol. 47, 147-66(1956) Feb.

8135
A COMPARISON OF TRIIODOTHYRONINE AND THYROXINE IN THE CHICK GOITER-PREVENTION TEST. C. J. Shellabarger (Brookhaven National Lab., Upton, N. Y.). Poultry Sci. 34, 1437-40(1955) Nov.

Triiodothyronine was compared to thyroxine by the goiter-prevention test in the rat and in agreement with previous findings, triiodothyronine was more potent than thyroxine. In the chick, by a similar goiter-prevention test, the response to triiodothyronine and thyroxine was not different. It was suggested that a species difference exists between the chick and rat in response to triiodothyronine and thyroxine. (auth)

8136
ON THE GERMINATION OF IMMATURE SEEDS OF CERTAIN VARIETIES OF TOBACCO IN THE PRESENCE OF LIGHT AND URANIUM SALTS. Camille Izard. Compt. rend. 242, 2027-30(1956) Apr. 16. (In French)

The grains of certain varieties of tobacco germinate with difficulty in the course of the first months which follow the harvest. The inhibition is due, very probably, to an excess of free auxin and can be removed either by light or by treatment with uranium salts; these last accelerate the photoinactivation of indol-β-acetic acid. (B.J.H.)

RADIATION EFFECTS

8137 NP-6060
Nataional Academy of Sciences and National Research Council.
PATHOLOGIC EFFECTS OF ATOMIC RADIATION. Publication 452. 1956. 208p. $1.00(NAS-NRC).

Data on the pathological effects of radiation are reviewed. The data include results of controlled experimental studies of acute and chronic effects on many species of animals, and available human data including the effects of excessive exposure to x radiation and radium used for therapy; moderate exposure to different forms of radiation as experienced by cyclotron workers; results of the introduction of naturally occurring radioelements such as radium preparations and thorotrast into the body; the effects of exposure to radiations from atomic explosions on the inhabitants of Hiroshima and Nagasaki; observations on populations irradiated by fall-out; and observations from clinical radiotherapy, the use of artificial isotopes in therapy, a limited number of accidents in atomic energy work, and certain statistical surveys of large groups. (938 references.) (C.H.)

8138 UR-443
Rochester, N. Y. Univ. Atomic Energy Project.
RADIATION CATARACTS. L. W. Tuttle. June 20, 1956. 8p. Contract W-7401-eng-49. $1.80(ph OTS); $1.80 (mf OTS).

Among the approximately 8000 exposed survivors of the Hiroshima and Nagasaki bombings who have been examined during the decade following their exposure to nuclear radiations, there have been found 10 cases of severe cataract, approximately 25 cases with slightly impaired vision, and perhaps two hundred cases with minimal lenticular changes detectable only by careful slit-lamp examination by specially trained personnel. It may be concluded that the Japanese atomic bomb explosions have resulted in negligible loss of vision to date. (auth)

8139 UR-455
Rochester, N. Y. Univ. Atomic Energy Project.
DETERMINATION OF THE RECOVERY FROM LETHAL EFFECTS OF LOWER BODY IRRADIATION IN RATS. Arland L. Carsten and Thomas R. Noonan. July 9, 1956. 66p. Contract W-7401-eng-49. $10.80(ph OTS); $3.90 (mf OTS).

Through use of a paired dose technique and application of related 30 day mortality data, the recovery rate from lower body x irradiation was determined. Data are tabulated and presented graphically. (auth)

8140 USNRDL-TR-91
Naval Radiological Defense Lab., San Francisco.
ON THE NATURE OF SERUM PROTEIN CHANGES IN

THE X-IRRADIATED DOG. W. H. Goldwater and C. Entenman. May 9, 1956. 20p. Project NM 006-015.

Paper electrophoresis techniques have been applied to the study of serum protein, lipoprotein, and glycoprotein changes in irradiated dogs. Through suitable staining techniques, alterations in the distribution of proteins, and protein-bound lipids, and polysaccharides have been noted. In the terminal stages following fatal doses of x irradiation, decreased alpha-1 globulin lipid reflects the loss of a lipoprotein component, which is correlated with the drop of the dense lipoprotein previously found in ultracentrifugal flotation studies. Increased lipid and polysaccharide materials in the alpha-2-3 globulins indicate that these components are carriers of increased quantities of lipoproteins and glycoproteins. Decreased alpha-4 polysaccharide represents lowered glycoprotein, and slight increases of beta globulin lipids reflect gains of lipoproteins in that region. The loss of alpha-4 and gain of alpha-3 glycoproteins have been found as early as ten days prior to irradiation death, and in the absence of lipoprotein or body temperature abnormalities. In dogs surviving irradiation doses near the LD_{50}, transitory lipoprotein changes were less pronounced than those found in the glycoprotein components. Possible mechanisms underlying these various serum protein changes are discussed. (auth)

8141 USNRDL-TR-95

Naval Radiological Defense Lab., San Francisco.

THE EFFECT OF WHOLE-BODY X IRRADIATION ON THE ELECTROCONVULSIVE THRESHOLD IN THE RAT. J. S. Schwartzbaum, E. L. Hunt, B. P. Davies, and D. J. Kimeldorf. May 24, 1956. 16p. Project 006-015.04.

Relatively little information is available concerning the effects of ionizing radiation upon the electrophysiological activity of the brain. The present study was designed to investigate the possible effects of x rays upon the threshold for electroshock induced seizure in the rat. Seizure thresholds were determined before and after x irradiation or sham-irradiation (control) treatment. Several groups of irradiated and control animals were tested during the first week post-irradiation in order to describe the time course for the effect. Following whole-body exposure to 500 r the electroconvulsive threshold was reduced. This decrement persisted throughout the six-day period of testing postirradiation. Significant changes were not detected in the magnitude of effect within this time period. The degree of threshold change produced by radiation exposure extended beyond the effect attributable to the post-irradiation decrease in body weight. (auth)

8142 USNRDL-TR-96

Naval Radiological Defense Lab., San Francisco.

SPATIAL AVOIDANCE BEHAVIOR IN THE RAT AS A RESULT OF EXPOSURE TO IONIZING RADIATION. J. Garcia, D. J. Kimeldorf, and E. L. Hunt. June 20, 1956. 14p. Project NM 006-015.04.

The use of radiation as a stimulus to motivate a spatial avoidance response is under investigation. In Experiment A, groups of sixteen rats were exposed to gamma radiation (17 r or 10 r/hr) for five hours while individually confined to one of two distinctive compartments of an enclosed alley. In Experiment B, eight animals were exposed to X ray at 60 r/hr during two-hour periods of confinement. Following a series of four confinements in the exposure compartment alternated with four confinements in the shielded compartment, the partition between the compartments was removed and each animal was allowed a free choice of residence in the alley as a test of conditioning. With but one exception, all the irradiated animals demonstrated a decreased preference for the compartment in which they had been exposed. It was concluded that both gamma and X rays can serve as stimuli to establish spatial avoidance behavior in the rat. (auth)

8143

A COMPARISON OF THE EFFECTS OF 31-MEV AND 180-KEV X RADIATION ON THE MITOSIS OF VICIA FABA L. Hedi Fritz-Niggle. Oncologia 9, No. 2, 269-79(1956). (In German)

8144

ACUTE MYELOID LEUKEMIA FOLLOWING PROLONGED IODINE-131 THERAPY FOR METASTATIC THYROID CARCINOMA. S. M. Seidlin, Edward Siegel, A. Aaron Yalow, and S. Melamed (Montefiore Hosp., New York). Science 123, 800-1(1956) May 4.

Two instances of acute myeloid leukemia are reported in a group of sixteen patients with metastatic thyroid carcinoma treated intensively with radioiodine. The radioiodine administered to this group of patients, commencing in 1943, ranged from 195 to 2290 mc over a 6-mo to 9-year interval. Brief summaries of the case histories are included. (C.H.)

8145

A NOTE ON THE USE OF RADIATION FOR THE PRODUCTION OF MUTATIONS FOR VICTORIA-BLIGHT RESISTANCE IN OATS. Calvin F. Konzak (Brookhaven National Lab., Upton, N. Y.). Phytopathology 46, 177-8 (1956) Mar.

8146

ON THE EFFECT OF NUCLEAR RADIATION OF PLANTS. P. A. Vlasyuk and D. M. Grodzinskiĭ (Inst. of Plant Physiology and Agrochemistry). Doklady Akad. Nauk S.S.S.R. 106, 562-4(1956) Jan. 21. (In Russian)

Studies of radioactive isotope effects on plants revealed many complicated and varying reactions produced by ionizing radiation. In some cases the same dose showed contrasting effects or no effects at all, depending on the temperature, nutrition level, or other external conditions. As a rule, the positive effects were produced by the small doses. Ionizing radiation produced two-phase reactions; small radiation doses intensified the physiological functions of the plant; the large doses slowed down and weakened the life functions of the cells and tissues, which eventually became restored to normal activity. Such two-phase reactions were observed in the study of Ca^{45} and P^{32} radiation on Saccharomyces cerevisiae. A similar parabiotic reaction was observed in Uromyces onobrychidis. A diagram is presented showing the effects of ionizing radioactive isotope Ca^{45} on the breathing functions of Saccharomyces cerevisiae culture (in % to the breathing intensity in stable isotope media). Experiments were carried out on sugar beet leaves and oat seeds. On the basis of the studies it may be concluded that the effects of ionizing radiation are determined by the functional conditions of the growing organism or by some of its separate organs. It is also possible that the radiation affects plants as background excitation. (R.V.J.)

8147

EFFECTS OF SMALL DOSES OF IONIZING RADIATIONS ON OXIDATION-REDUCTION PROCESSES IN PLANTS. P. A. Vlasyuk, Z. M. Klimovitskaya, and E. S. Kosmatiĭ (Ukraine Inst. of Plant Physiology and Agrochemistry). Doklady Akad. Nauk S.S.S.R. 106, 731-4(1956) Feb. 1. (In Russian)

Tracer studies of radioactive Ca^{45}(5 to 10 μc per plant) effect on sugar beet yield and the effects of small doses of P^{32}, Ca^{45}, and S^{35} in the food supply of sugar beets and clover are tabulated and discussed. The studies established that in the early stages of growth of sugar beets the ionizing radiation increased the oxidation and lowered the reduction processes. Considerable increase of reduction processes over the oxidation which resulted in richer sugar beet yield were observed towards the end of the vegetative period.

Larger ionizing radiation doses in clover plants increased oxidation and suppressed the reduction process. In clover plants small doses of radioactive S^{35} have intensified the oxidation, the tissue iodo-reducing properties, and the content of reducing forms of ascorbic acid. (R.V.J.)

8148

THE RESTORATION OF HEMOLYSIN-FORMING CAPACITY IN X-IRRADIATED RABBITS BY TISSUE AND YEAST PREPARATIONS. Bernard N. Jaroslow and William H. Taliaferro (Argonne National Lab., Lemont, Ill. and Univ. of Chicago). J. Infectious Diseases 98, 75-81(1956) Jan.-Feb.

8149

MODIFICATION OF RADIATION-INDUCED GENETIC DAMAGE. Alexander Hollaender and R. F. Kimball (Oak Ridge National Lab., Tenn.). Nature 177, 726-30(1956) Apr. 21.

A review article of recent developments and present-day research on the genetic effects of radiation is presented. (C.W.H.)

8150

GENETIC EFFECTS OF X-RAYS IN RELATION TO DOSE-RATE IN DROSOPHILA. A. M. Clark (Univ. of Melbourne, Australia). Nature 177, 787(1956) Apr. 28.

Using dose rates of 100 r/min and 2000 r/min, it has been confirmed that, for a given dose, a greater amount of genetic damage is produced if the radiation is delivered at high intensity. The intensity effect is enhanced if the flies are injected with 0.005M sodium azide in saline just prior to irradiation. (B.J.H.)

RADIATION HAZARDS AND PROTECTION

8151 NYO-5237

[Mallinckrodt Chemical Works, St. Louis.]

THE ROLE OF PRIMARY BETA RADIATION IN AREA RADIATION DOSE RATES; PLANT SIX [URANIUM ORE REFINERY] DIGEST AREA. R. F. Nagel. Nov. 17, 1950. Changed from OFFICIAL USE ONLY Oct. 24, 1955. 14p. $3.30(ph OTS); $2.40(mf OTS).

A survey was made of the Digest Area to analyze the possibility of reducing personnel radiation exposure by better housekeeping in the area. The results of two independent experiments show that better housekeeping would contribute little to the reduction of personnel exposure, the limiting case being an 18.6% reduction in the total exposure. (auth)

8152 USNRDL-TR-77

Naval Radiological Defense Lab., San Francisco.

UPTAKE, DISTRIBUTION, AND RETENTION OF FISSION PRODUCTS IN TISSUES OF MICE EXPOSED TO A SIMULANT OF FALLOUT FROM A NUCLEAR DETONATION. I. SIMULANT OF FALLOUT FROM A DETONATION UNDER SEAWATER. S. H. Cohn, W. B. Lane, J. K. Gong, J. C. Sherwin, R. K. Fuller, L. L. Wiltshire, and W. L. Milne. Dec. 5, 1955. 25p. Project No. NM-006-015.04.

In an acute inhalation exposure of mice to a simulated early fallout from a nuclear detonation in seawater, the uptake, distribution, and retention of fission products were studied. Also studied was the influence of chemical agents on uptake, distribution, and retention. The quantity of fission products taken up was proportional both to the length of exposure and the concentration of airborne radioactivity. The internally deposited isotopes were chiefly those of short radioactive and biological half-life. Those deposited in the skeleton primarily were long-lived and were removed very slowly. Although in the different soft tissues the radioactive decay was quite similar soon after exposure, the rate of the biological decay in these tissues varied. The injection of Zr citrate prior to and just after exposure resulted in a considerable decrease in the concentration of fission products in the skeleton and soft tissues. Sodium ethylene diamine tetraacetic acid (EDTA) caused no significant change. The relatively small uptake of fission products and rapid turnover in the tissues adds to the evidence that the internal radiation hazard following an acute inhalation exposure to fallout is very small. (auth)

8153 USNRDL-TR-97

Naval Radiological Defense Lab., San Francisco.

HISTOCHEMICAL DEMONSTRATION OF THE DISTRIBUTION OF INJECTED RAT BONE MARROW GROWING IN X-IRRADIATED MICE. P. C. Nowell, L. J. Cole, P. L. Roan, and J. G. Habermeyer. June 13, 1956. 27p. Project NM-006-015.04.

The mechanism by which injected rat bone marrow modifies the response of lethally x-irradiated mice has been investigated by means of the histochemical alkaline phosphatase technique. By this method, the actual tissue distribution and growth pattern of the injected rat cells can be studied. Following intravenous injection, phosphatase-positive rat cells rapidly colonized the mouse spleen and marrow cavity, but not the lung or thymus. By two weeks after irradiation, the hematopoietic organs of the recipient mouse were repopulated with rat marrow, which provided enough circulating blood cells to prevent death from acute radiation injury. Intraperitoneal injection of rat marrow failed to protect against radiation death. Although the cells grew readily in the abdominal cavity of the irradiated mouse, foci of phosphatase-positive (rat) cells did not appear at other sites until 9 days after irradiation, too late to permit survival of the heterologous host. After intraperitoneal injection of isologous (mouse) marrow, however, foci of hematopoiesis appeared in the spleen and bone marrow within 5 to 7 days, and approximately half of these animals survived. (auth)

8154

CRITERIA FOR EVALUATING GAMMA RADIATION EXPOSURES FROM FALLOUT FOLLOWING NUCLEAR DETONATIONS. Gordon M. Dunning (Division of Biology and Medicine, U. S. Atomic Energy Commission, Washington). Radiology 66, 585-94(1956) Apr.

The biological effects of γ radiation from fall-out incident to nuclear detonations are evaluated. The relationship between radiation doses and biological effects is discussed. Factors to be considered in applying the results of laboratory experiments to calculations of exposures under field conditions are considered. Contributions of weathering, shielding, time of dose, fall-out pattern, and protective measures to the γ dose from fall-out are summarized. (C.H.)

8155

SUGGESTED PROCEDURE FOR PERFORMANCE OF AUTOPSIES ON CADAVERS CONTAINING RADIOACTIVE IODINE. Russell F. Cowing and Egilda DeAmicis (New England Deaconess Hospital, Boston). Am. J. Clin. Pathol. 26, 29-35(1956) Jan.

Procedures are outlined for the protection of personnel during the performance of autopsies on cadavers containing radioactive iodine. (C.H.)

8156

MEASUREMENTS ON RADIATION PROTECTION REQUIRED IN THE WALLS OF ROENTGEN DIAGNOSTIC ROOMS. Lars-Eric Larsson. Acta Radiol. 45, 249-54 (1956) Mar.

In order to ascertain the amount of radiation which actually strikes protective barriers, measurements with

ionization chambers have been made on the walls of roentgen diagnostic rooms. In no case did the dose values exceed 400 mr/week. A statistical analysis shows that a weekly dose of 500 mr is not reached once in two years under maximum working conditions in Sweden. Some explanations are put forward of the difference between the dimensions of protective barriers given as a consequence of these measurements and those internationally required. (auth)

8157
FAILURE OF ZYMOSAN TO INCREASE SURVIVAL IN X-IRRADIATED MICE. Thomas J. Haley, W. G. McCormick, E. F. McColloh, and Anna M. Flesher (University of Calif., Los Angeles). Proc. Soc. Exptl. Biol. Med. 91, 438-40 (1956) Mar.

RADIATION SICKNESS

8158
STRUCTURAL CHANGES IN PERICELLULAR APPARATUS EFFECTED BY TOTAL X RADIATION. V. V. Kupriyanov (Naval Medical Acad.). Doklady Akad. Nauk S.S.S.R. 106, 921-2(1956) Feb. 11. (In Russian)

Animals exposed to total x irradiation suffered from disorders of the regular innervation functions in the nervous apparatus of their hearts. The receptory heart apparatus of the animals was damaged, the bonds between neurons were destroyed, and some nerve cells in the intramural ganglions have perished. All these defects could be the source causing damages to the vascular system of the heart and producing serious pathological symptoms. (R.V.J.)

RADIOTHERAPY

8159 ACRH-5
Argonne Cancer Research Hospital, Chicago.
SEMIANNUAL REPORT TO THE ATOMIC ENERGY COMMISSION. Leon O. Jacobson and Antreen Pfau, eds. Mar. 1956. 84p. Contract AT-(11-1)-69. $13.80(ph OTS); $4.80(mf OTS).

Topics discussed include: the reaction of brain tissue to β radiation; a method for using γ-emitting isotopes in solution in plane interstitial applicators inserted in the mediastinum in dogs; the preparation of applicators for the irradiation of the posterior ocular segment with Y^{90}; the production of experimental myocardial infarction by local β irradiation; placental transfer of radioactive digitoxin in pregnant women and its fetal distribution; the synthesis and excretion of Bence-Jones protein in multiple myeloma; an interpretation of organ weight change induced by total-body irradiation; instrumentation and dosimetry for the high-energy proton beam of the synchrocyclotron; the activation of Co^{60} for use in moving beam therapy; the infrared microanalysis of solids using pressed potassium bromide pellets; and studies on plasma factors affecting red cell production. (For preceding period see ACRH-4.) (C.H.)

8160
A NEW TELEGAMMA APPARATUS. Bo Lindell and Rune Walstam. Acta Radiol. 45, 236-48(1956) Mar.

A telegamma unit, loaded with 8.5 curies of radioactive cobalt is described. The unit is intended for treatment with a source—skin distance of 6 to 10 cm. The employment of a 6 mm source makes it possible to use diaphragms defining different field sizes and shapes, well preserved even at a depth. Apart from other advantages, it is believed that the new unit gives safer handling than previous constructions. (auth)

8161
HORMONES AND RADIOACTIVITY IN CANCER THERAPY. Franklin T. Brayer, Stanley R. Glasser, and Joe W. Howland (Univ. of Rochester School of Medicine and Dentistry, N. Y.). N. Y. State J. Med. 56, 905-9(1956) Mar. 15.

A summary of current methods of use of hormones and radioactive isotopes in cancer therapy has been presented. Specific use of these newer technics is necessary if benefit is to be gained by the cancer patient. (auth)

TOXICOLOGY STUDIES

8162 MLCR-30
Pittsburgh. Univ. Graduate School of Public Health.
INTERIM REPORT FOR THE FIRST, SECOND, THIRD AND FOURTH QUARTER ON BORON ANALYSIS [FOR 1952–1953]. W. H. Hill and J. L. Svirbely. Mar. 1954. 104p. Contract DA-18-108-CML-3910.

Data are presented from studies on the toxicology, mechanisms of action, and methods of analysis for B and B compounds in animal tissues and air mixtures. Data are included from chronic toxicology studies employing rats, dogs, guinea pigs, and rabbits. Methods for the determination of B and B compounds in air mixtures, animal tissues, blood, and urine are included. Data are included on the effects of vitamins E and C, BAL, and quinoline on rats poisoned with decaborane. (C.H.)

8163 UR-460
Rochester, N. Y. Univ. Atomic Energy Project.
INHALATION TOXICITY OF ZIRCONIUM COMPOUNDS. I. SHORT-TERM STUDIES. C. J. Spiegl, M. C. Calkins, J. J. DeVoldre, J. K. Scott, L. T. Steadman, and H. E. Stokinger. July 9, 1956. 26p. Contract W-7401-eng-49. $4.80(ph OTS); $2.70(mf OTS).

A total of 270 animals of 5 species was exposed by inhalation to compounds of Zr for 6 hr/day, 5 day/week. One group of animals was exposed to ZrO_2 at an atmospheric concentration of 75 mg Zr/m^3 for 30 days; another to 11 mg Zr/m^3 for 60 days. A third group was exposed to a mist of $ZrCl_4$ at a level of 6 mg Zr/m^3 for 60 days. Zirconium oxide produced no significant changes in mortality, growth rate, blood nonprotein nitrogen or fibrinogen, urinary protein, hematological values or histological structure. Zirconium tetrachloride at 6 mg Zr/m^3 gave questionable changes in blood hemoglobin concentration and red cell counts of dogs and a slight increase in mortality of rats and guinea pigs. Inhaled Zr compounds deposited primarily in the lung and pulmonary lymph node, with a fraction of a per cent in the bone and considerably less in the soft tissues. (auth)

Refer also to abstract 8146.

TRACER APPLICATIONS

8164 AECU-3262
Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies.
THE CHICAGO SUNSHINE METHOD; ABSOLUTE ASSAY OF STRONTIUM-90 IN BIOLOGICAL MATERIALS, SOILS, WATERS, AND AIR FILTERS. E. A. Martell. May 1956. 65p. Contract AT(11-1)-281. $0.40(OTS).

The analytical techniques and counting method developed for the routine absolute assay of trace levels of Sr^{90} activity in a wide variety of biological and inorganic materials are discussed. Details are furnished to make this a useful guide book. The counting method has wide application for the absolute assay of other beta emitters. The counter and procedures provide a background of about 0.15 counts/min and allow the determination of total Sr^{90} activities of as little as one disintegration per minute with high precision. (F.S.)

8165
RADIOACTIVE TRACER TESTS FOR THE RECOGNITION AND IDENTIFICATION OF VITAMIN B_{12} DEFICIENCY STATES. Julius R. Krevans, C. Lockard Conley, and Marie V. Sachs (Johns Hopkins Univ. School of Medicine and Hospital). J. Chronic Diseases 3, 234-52(1956) Mar.

8166
DISTRIBUTION OF ALPHA-RADIOACTIVITY IN CERTAIN FOREST TYPES. John T. Curtis and Ralph Dix (Univ. of Wisconsin, Madison). Science 123, 799-800(1956) May 4.

Eighty stands of hardwood and conifer forest in Wisconsin and in the Southern Appalachian region were examined for α radioactivity in the leaves of dominant trees, of dead and decomposing litter, and of the topsoil and subsoil. The vertical distribution of α radioactivity from subsoil to living leaves was similar in all forest types that were examined in both geographic regions. Data are tabulated. (C.H.)

8167
THE SITE OF DEPOSITION OF Y^{91} IN THE BONES OF RABBITS AND DOGS. J. Jowsey, H. A. Sissons, and J. Vaughn (Nuffield Dept. of Medicine, Oxford, and Institute of Orthopaedics, London). J. Nuclear Energy 2, 168-76(1956) Mar.

The authors describe the sites of deposition of Y^{91} in the bones of normal rabbits and of normal and rachitic puppies. The retention and excretion of both Sr^{90} and Y^{91} in normal and rachitic puppies following a single intravenous injection of the two isotopes is also reported. The retention of Sr^{90} and Y^{91} was high and of the same order in both groups for as long as seven days after injection. Autoradiographic studies showed a different pattern of deposition for Sr^{90} and Y^{91}. Sr^{90} was found in areas of active bone growth in both normal and rachitic puppies following the pattern already described for rabbit and monkey bone. Y^{91} was never found in either osteoid tissue or in areas of active calcification. It was heavily concentrated on bone surfaces where active resorption was either in progress or had just occurred and in association with small completed Haversian systems. The areas where Y^{91} was concentrated showed a strongly positive PAS reaction in undecalcified sections fixed in alcohol. The apparent changes in localization of Y^{91} at varying periods after uptake, can be explained in terms of normal growth and remodelling of bone. (auth)

8168
RADIOIODIDE IN THE THYROID AND IN OTHER ORGANS OF RATS TREATED WITH LARGE DOSES OF PERCHLORATE. N. S. Halmi, R. G. Stuelke, and M. D. Schnell (State Univ. of Iowa, Iowa City). Endocrinology 58, 634-50(1956) May.

8169
CARDIAC OUTPUT MEASURED BY THE INJECTION METHOD WITH USE OF RADIOACTIVE MATERIAL AND CONTINUOUS RECORDING. RESULTS OF CIRCULATION MODEL STUDIES. Milton G. Crane, Ralph Adams, and Ivor Woodward (College of Medical Evangelists, Los Angeles). J. Lab. Clin. Med. 47, 802-10(1956) May.

WASTE DISPOSAL

8170
FISSION PRODUCT DISPOSAL FROM WINDSCALE. P. V. Danckwerts (Atomic Energy Authority, Risley, England). Nuclear Eng. 1, 25-7(1956) Apr.

Experiments were made on the dispersal effects of tide and wind on bulk dumpings of fluorescein in the sea followed by investigations into concentration characteristics of silt, seaweed and fish, before the low activity effluent was discharged into the sea at Windscale. Several years continuous disposal by this technique proves that initial estimates erred on the side of safety. (auth)

CHEMISTRY

8171 MCC-1023-TR-203
Michigan State Univ., East Lansing.
THE ELECTROLYSIS OF OXYGENATED BORON-CONTAINING MATERIALS (thesis). Harry E. Ulmer. 1955. 151p. [For Olin Mathieson Corp. Contract NOa(s)52-1023-c].

A study of the electrolytic properties of oxygenated boron compounds with the idea of producing the boranes, particularly diborane, or substituted boron compounds which could be easily converted into the latter is presented. Compounds of the type, $NaBH_n(OCH_3)_{4-n}$, where n may be varied from zero to four, were considered. Most of the emphasis was placed on the electrolysis of sodium trimethoxyborohydride, $NaBH(OCH_3)_3$, in several nonaqueous solvents such as dimethylformamide and ethylene glycol dimethyl ether. Some observations are reported on the systems boric oxide–sulfur trioxide, boric oxide–sulfur trioxide–water, and boric oxide–phosphorus pentoxide–water. (auth)

8172 MD-169
Canada. Dept. of Mines and Technical Surveys.
THE SEPARATION AND IDENTIFICATION OF THE TITANIFEROUS AND SILICEOUS CONSTITUENTS OF SLAG FROM THE QUEBEC IRON AND TITANIUM CORPORATION, SOREL, P. Q. S. A. Forman, A. T. Prince, and N. F. H. Bright. Apr. 27, 1954. 77p.

The titanium-rich slag produced by Quebec Iron and Titanium Corporation, Sorel, P. Q. consists of a titaniferous phase composed of a solid solution of ferrous and magnesium dititanates with aluminum and titanium titanates (Ti_3O_5) and a siliceous portion which is composed of a solid solution of anorthite and albite, a small amount of orthoclase, and a considerable amount of mixed metasilicates of Fe, Ca, and Mg. A large amount of this portion is in the amorphous or glassy condition. The two components are chemically independent and theoretically separable. The titaniferous phase has a titanium equivalent of 80 to 88% TiO_2, as shown by various samples. It is not readily possible by any reasonable program of grinding followed by sink/float separation to remove more than 50% of the siliceous material. Such removal involves the loss of only 2 to 3% of the total Ti present. The product has a Ti equivalent of approximately 75 to 78%. (auth)

8173 MD-172
Canada. Dept. of Mines and Technical Surveys. Mines Branch.
ADDITIONAL WORK ON TITANIFEROUS SLAGS FROM THE QUEBEC IRON AND TITANIUM CORPORATION, SOREL, P. Q. Norman F. H. Bright. Nov. 1, 1954. 28p.

The sink/float separation program is slightly more efficient in segregating the titaniferous from the siliceous portion in the case of the core of a slag ingot than with the remainder of the ingot, due to rather coarser grain size; there is, however, no significant difference in composition of the two materials. (auth)

8174 MD-201
Canada. Dept. of Mines and Technical Surveys. Mines Branch.
AN INVESTIGATION OF THE MELTING POINTS AND CERTAIN PHASE RELATIONSHIPS IN THE SYSTEM MAGNESIUM ORTHOSILICATE, MAGNESIUM ORTHOTITANATE, MAGNESIOFERRITE. M. Ramakrishna Rao. Apr. 20, 1956. 40p.

An investigation of the variation of the fusion points in the system forsterite—magnesium orthotitanate—magnesioferrite has been made. X-ray data are given for the crystalline phases encountered in the system. Cone softening and melting determinations have been made in the binary joins and in a limited area of the ternary system. The solid solution phenomenon between magnesium orthotitanate and magnesioferrite has been studied by the measurement of the unit cell edges as determined by x-ray-diffraction. The effect of the presence of iron oxide and titania in forsterite refractories is discussed in relation to the results obtained in this investigation. (auth)

8175 MD-2890

Canada. Dept. of Mines and Technical Surveys. Mines Branch.

MICROSCOPE EXAMINATION OF TITANIA SLAGS FROM QUEBEC IRON AND TITANIUM CORPORATION, SOREL, P. Q. P. D. S. St. Pierre. Apr. 29, 1952. 10p.

MD-3069 is a further report on this investigation.

Although a comprehensive statement of the mineralogy of these slags cannot be given at this time, it would appear that there is little mineralogical or structural difference between any of the samples examined in this laboratory. The only outstanding difference between the various slags in the present set of samples was the presence of a thin chilled layer on the surface of the quenched slags. All slags, however, showed a slight textural variation near the cooling surfaces. The difference in iron content between the samples appeared to have no effect on the nature and distribution of the several phases normally observed. The precipitation of a platy silvery phase from some of the dititanate suggests the existence of solid solutions. The presence of these latter phases might explain possible chemical differences. The tendency for precipitation to occur at the center of the dititanate crystals may be due to a zoning effect. Thus, the outer layers of the crystal may not be saturated with respect to the silvery phase and would not therefore be subject to its precipitation on cooling. The dendritic nature of the laths sometimes seen in the glassy matrix surrounding the dititanate indicates that they have precipitated in a liquid, rather than in a solid. The composition of these dendrites is not known, but they may represent a second growth of dititanate. (auth)

8176 MD-3010

Canada. Dept. of Mines and Technical Surveys. Mines Branch.

A STUDY OF SOME LIME-BEARING TITANIA SLAGS FROM QUEBEC IRON AND TITANIUM CORPORATION, SOREL, P. Q. N. F. H. Bright and S. A. Forman. Dec. 22, 1953. 8p.

The addition of lime to the normal slag, which is chiefly a solid solution of dititanates, does not change its character to any great extent, in that dititanate remains as the main constituent. Where the CaO content was 5.5%, the lime combined with the titania to form perovskite ($CaTiO_3$). Where the CaO content was 8.6%, in addition to the formation of perovskite, the lime seemed to break down the $Al_2O_3 \cdot TiO_2$ (which is the form in which the alumina is believed to exist in the slag) to form calcium aluminate ($CaAl_2O_4$). It seems reasonable to conclude, that the addition of a small amount of lime to the slag will result in the formation of perovskite. On the other hand, at some higher value between 5.5 and 8.6% the lime no longer forms perovskite only, but also combines with the alumina in the slag to form calcium aluminate. During the course of leaching of the slags in H_2SO_4 most of the lime combines with the acid to form $CaSO_4$ which remains in the residue of which it forms the principle ingredient. Minor amounts of dititanates and titanates persist in the residue, but this would undoubtedly be dependent on the precise method of digestion which is unknown to the authors. (auth)

8177 MD-3069

Canada. Dept. of Mines and Technical Surveys. Mines Branch.

EXAMINATION OF METALLIC PRILLS IN SLAG FROM QUEBEC IRON AND TITANIUM CORPORATION, SOREL, P. Q. P. D. S. St. Pierre. Jan. 19, 1955. 4p.

This is a further report on investigation in MD-2890.

The small complex metallic prills found in the slag represent a sulfur-bearing Fe phase precipitated from the original melt. (auth)

8178 MD-TR-560-CC

Canada. Dept. of Mines and Technical Surveys. Mines Branch.

MELTING POINT OF TITANIA SLAG FROM QUEBEC IRON AND TITANIUM CORPORATION, SOREL, P. Q. P. D. S. St. Pierre. July 28, 1952. 5p.

Both high and low Fe samples of slag commence deformation at 1575°C. The test cones collapse from the bottom thereby making it impossible to be certain whether melting of the slag is taking place or attack on the mount. The identical results obtained for both periclase and zirconia mounts suggest that normal melting rather than corrosion is taking place. Microscope examination indicates that little oxidation takes place during the run. (auth)

8179 MD-TR-563-CC

Canada. Dept. of Mines and Technical Surveys. Mines Branch.

EVALUATION OF THE QUENCHING METHOD FOR MELTING POINT DETERMINATIONS ON TITANIA SLAG FROM QUEBEC IRON AND TITANIUM CORPORATION, SOREL, P. Q. A. T. Prince. Aug. 13, 1952. 6p.

The titania slags evidently react with platinum at high temperatures even in the presence of inert gases. A change in O_2 distribution occurs such that abundant rutile is formed. Carbon containers do not change the constitution of the slag on heating with an inert gas atmosphere. The physical appearance of the quenched charges run in C, at the three temperatures indicates that softening and fusion occur between 1558 and 1608°C, but under the circumstances, closer limiting of the softening and fusion range did not appear warranted. The titania slags failed to give a glassy product on quenching, even though the formation of rounded pellets suggested that the charge was essentially liquid at furnace temperatures. (auth)

8180 NOLC-324

Naval Ordnance Lab., Corona, Calif.

HIGH-TEMPERATURE DIELECTRIC MATERIALS. Interim Report No. 9 [for] October–December 1955. Apr. 17, 1956. 21p. (NAVORD-4572).

Continued work on the preparation of bis-(m-perfluoromethylphenyl)-vinylsilane has resulted in improved yields and the elimination of some difficulties in the fractionation. The reaction of diphenylvinylsilane with a platinum-on-carbon catalyst has been shown to be a rearrangement of coupling accompanied by the liberation of hydrogen and low molecular-weight hydrocarbons. The reaction of $(CF_3)_2PCl_3$ and NH_4Cl at 105°C has led to the formation of large quantities of chloroform but as yet no phosphinic nitride materials have been produced. Work has been reinstituted on the diphenylphosphinic nitride materials and the preparation of ϕ_2PCl_3 has been accomplished. The reaction of CF_3I and aluminum using an aluminum alkyl catalyst has been studied. The evidence is incomplete but it appears that no perfluoroalkyl iodides have resulted from this reaction. (auth)

8181 NP-5941

Utah. Univ., Salt Lake City. Inst. For The Study Of Rate Processes.

THE APPLICATION OF PROBABILITY THEORY TO EXPLOSIVE-IGNITION PHENOMENA. Technical Report No. 17. Ransom B. Parlin and J. Calvin Giddings. Sept. 30, 1955. 19p. Project NR-051-192. Contract N7-onr-45103.

A theory of explosive ignition based on the probability of occurrence of local energy fluctuations is discussed. Application of the theory to several examples of impact ignition, with and without grit particles, gave good agreement with experimental results. (C.W.H.)

8182 NYO-7711

Pennsylvania State Univ., University Park. Coll. of Chemistry and Physics.

STUDIES ON COORDINATION COMPOUNDS. XVII. THE CHELATING TENDENCIES OF SOME β-DIKETONES TOWARD BERYLLIUM AND URANYL IONS AND OF METHOXYACETYLACETONE AND CURCUMIN TOWARD A VARIETY OF DIVALENT IONS. David M. Ericson and W. Conard Fernelius. May 1956. 5p. Contract AT(30-1)-907. $1.80(ph OTS); $1.80(mf OTS).

Formation constants for the chelation of a variety of β-diketones with a number of divalent ions have been determined at 30°C in 75 volume percent dioxane. The systems studied were: methoxyacetylacetone with Cu^{2+}, Ni^{2+}, Co^{2+}, Mn^{2+}, and Mg^{2+} (as perchlorate salts), and with Be^{2+}, Zn^{2+}, and UO_2^{2+} (as nitrate salts); curcumin with Cu^{2+}, Zn^{2+}, Ni^{2+}, and UO_2^{2+}; and of several β-diketone with Be^{2+} and UO_2^{2+}. The chelates of Be^{2+} and UO_2^{2+} resemble those of Cu^{2+} in their stability and the order of stabilities of various metals with methoxyacetylacetone and curcumin is generally the same as that with other β-diketones. (auth)

8183 AEC-tr-2514

THE KINETICS OF WUESTITE FORMATION IN THE OXIDATION OF IRON. Karl Hauffe and Harald Pfeiffer. Translated from Z. Metallkunde 44, 27-36(1953). 25p.

The case of a linear character of the time-product curve of a metallic oxidation, which is unusual for the formation of compact cover layers, is observed and explained under given conditions for the oxidation of iron. The chemisorption of the O_2 formed by decomposition of CO_2 is considered as a time-determining partial step of the oxidation. The applicability of the Wagner scale theory to the oxidation of Fe in strongly oxidizing atmospheres, and contrastingly, to the growth of FeO in CO_2-CO gas mixtures at high temperatures, which is independent of the layer thickness, is explained kinetically. The velocity constants are determined as a function of the Wuestite formation and the disorder concentrations are determined as functions of the composition of the gaseous mixtures and of the temperature. Further, the mobility of the holes is determined indirectly. (auth)

8184 AEC-tr-2533

THE KINETICS OF THE REACTION BETWEEN CALCIUM AND NITROGEN. A. von Antropoff and E. Germann. Translated from Z. physik. Chem. 137, 209-37(1928). 37p.

The aim of this work was to determine the causes for the variations in the reactivity with N of various Ca samples. It was found that the reaction proceeded very rapidly when both reactants were extremely pure. Older, deviating observations were erroneous and must be attributed to the presence of O in N. The presence of nitride has no effect on the reactivity. High activities were due to microscopic occlusions of metallic Na immediately below the surface of the Ca; they could also be produced artificially by adding traces of Na to the Ca surface. The Na only starts the reaction and has otherwise no effect on its course; it is therefore not a catalyst but an "exciter" (stimulant). (auth)

8185 AEC-tr-2541

CHEMICAL AND THERMODYNAMIC STUDIES ON MERCUROUS AZIDE AND LEAD AZIDE. Shin Suzuki. Translated from J. Chem. Soc. Japan, Pure Chem. Sect. 73, 278-9(1952). 6p.

8186 AEC-tr-2543

THE RELATIONSHIP BETWEEN CONCENTRATION AND ACTIVITY IN FUSED SALT MIXTURES. H. Flood, O. Fykse, and S. Urnes. Translated from Z. Elektrochem. 59, 364-70(1955). 20p.

The activities of the salt components of the four binary mixtures NaF−KCl, NaCl−KF, LiF−KCl, and LiCl−KF are determined from the liquid curves of the equilibrium diagrams. The results are compared with the values calculated with the help of a general formula for the activities in salt mixtures. It becomes evident that in all the mixtures the deviations from the ideal agree with Temkin's structural model of the fusions. With higher lattice energies (NaF, LiF), a simplified theoretical formula clearly randers values which are slightly too high for the activity coefficients of their components. For components with lower lattice energies the agreement is quite satisfactory; because of solidification of the solutions, however, the components NaCl and KCl cannot be more thoroughly examined. (auth)

8187 AEC-tr-2544

CHEMICAL AND THERMODYNAMIC STUDIES ON SILVER AZIDE AND THALLIUM AZIDE. Shin Suzuki. Translated from J. Chem. Soc. Japan. Pure Chem. Sect. 73, 150-2 (1952). 9p.

8188 AERE-Lib/Trans-607

THE DECOMPOSITION POTENTIALS AT VARIOUS CURRENT DENSITIES IN THE SYSTEMS $AsBr_3-C_2H_5\cdot O\cdot C_2H_5$ AND $SbCl_3-C_2H_5\cdot O\cdot C_2H_5$. [PART] I. O. K. Kurda and G. S. Kleibs. Translated by J. B. Sykes from Zhur. Fiz. Khim. 15, 228-33(1941). 7p.

8189 AERE-Lib/Trans-608

AN ELECTROCHEMICAL INVESTIGATION OF THE TERNARY SYSTEM $AlBr_3-AsBr_3-$BENZENE. V. A. Plotnikov and S. I. Yakubson. Translated by J. B. Sykes from Zhur. Fiz. Khim. 8, 159-64(1936). 6p.

The electric conductivity of the $AlBr_3-AsBr_3-C_6H_6$ system exhibits a maximum at equimolar concentrations of $AlBr_3$ and $AsBr_3$. On electrolysis, As is produced at the cathode and Br_2 at the anode. The rate of formation of the $AlBr_3\cdot AsBr_3$ complex in benzene is determined. (C.W.H.)

8190 AERE-Lib/Trans-609

AN ELECTROCHEMICAL INVESTIGATION OF THE SYSTEM $AlBr_3-AsBr_3$ IN ETHYL BROMIDE. V. A. Plotnikov and S. I. Yakubson. Translated by J. B. Sykes from Zhur. Obshcheĭ Khim. 6, 1694-7(1936). 7p.

The electric conductivity of the $AlBr_3-AsBr_3-C_2H_5Br$ system decreases as the $AsBr_3$ concentration increases. On electrolysis, As is produced at the cathode and Br_2 at the anode. Results suggest the formation of an $AlBr_3\cdot AsBr_3$ complex. (C.W.H.)

8191 AERE-Lib/Trans-622

THE SOLID HYDROXY SALTS OF BIVALENT METALS. Walter Feitknecht. Translated by F. Hudswell from Fortschr. chem. Forsch. 2, 670-757(1953). 90p.

A summary is presented of newest developments in the chemistry of hydroxy salts. Formation reactions, chemical composition, transformation reactions, and structure are discussed. (W.L.H.)

8192 AERE-Lib/Trans-716

THE DETERMINATION OF THERMODYNAMIC ACIDITY CONSTANTS. R. G. Bates and G. Schwarzenbach. Translated by E. Wait from Helv. Chim. Acta 37, 1069-79 (1954). 13p.

The determination of thermodynamic acidity constants (dissociation constants) requires the elimination of all salt effects by extrapolation to zero ionic strength. Laborious curve-fitting may be necessary, and the results may be of low accuracy unless an extensive series of data is available. It is shown that the extrapolation may be reduced to the simple extension of a straight line of small slope when suitable experimental data are combined in the proper way. Measurements of spectral absorption and of emf taken together will yield thermodynamic acidity constants not obtainable by either method alone. The procedures are illustrated by the determination of the acidity constants for three uncharged acids (p-nitrophenol, 2,4-dinitrophenol and 4-chloro-2,6-dinitrophenol) and for three cationic acids (m-nitroanilinium ion, p-chloroanilinium ion, and N,N-diethyl-p-toluidinium ion). (auth)

8193 AERE-Lib/Trans-745

THE CONSTITUTION AND COLOUR OF THE NITROPHENOLS. A. Hantzsch. Translated by M. H. Rand from Ber. deut. keram. Ges. 39, 1084-1105(1906). 17p.

8194

THE SYNTHESIS OF NITROGEN-CONTAINING KETONES. V. THE DIRECT ACYLATION OF 3-PICOLINE. Alfred D. Miller, Carl Osuch, Newton N. Goldberg, and Robert Levine (Univ. of Pittsburgh). J. Am. Chem. Soc. 78, 674-6(1956) Feb. 5.

The direct acylation of 3-picoline with aromatic and heterocyclic esters using potassium amide as the condensing agent is described. The structure of one of the ketones, 3-phenacylpyridine, was established by reducing it to 3-(2-phenylethyl)-pyridine, authentic samples of which were prepared by two independent routes. (auth)

8195

A COMPARISON OF RANEY NICKEL AND RANEY COBALT CATALYSTS FOR THE HYDROGENATION OF OXIMES. Wilkins Reeve and Jack Christian (Univ. of Maryland, College Park). J. Am. Chem. Soc. 78, 860-1(1956) Feb. 20.

A comparison of Raney Co and Raney Ni catalysts for the hydrogenation of 6 oximes has been made. Raney cobalt generally produced primary amines of as high purity and yield as did Raney Ni. In some cases, Raney Co produces best results in ethanol or dioxane solvent without addition of NH_3, whereas Raney Ni often requires an ammoniacal solvent for best results. With both catalysts, both the solvent and the presence or absence of NH_3 have an important bearing on the yield and purity of the primary amine obtained. (auth)

8196

THE DECOMPOSITION OF OZONE IN AQUEOUS SOLUTION. Mary L. Kilpatrick Claude C. Herrick, and Martin Kilpatrick (Illinois Inst. of Tech., Chicago). J. Am. Chem. Soc. 78 1784-9(1956) May 5.

The rate of decomposition of ozone in aqueous $HClO_4$ has been measured spectrophotometrically, iodometrically, and manometrically, and found proportional to the three-halves power of the ozone concentration, in agreement with the proposed reaction scheme. In connection with the kinetic experiments, the molar extinction coefficient of ozone at 260 mμ, and the Henry's law constant, have been determined for solutions of ozone in 0.01M $HClO_4$. As in the case of hydrogen peroxide, it is difficult to obtain reproducible rates of decomposition from day to day, and the greater proclivity of ozone to explosion during purification makes the problem more troublesome. (auth)

8197

THE THERMODYNAMICS OF THIOSULFATE ION. Howard C. Mel, Z. Z. Hugus, Jr., and Wendell M. Latimer (Univ. of Calif., Berkeley). J. Am. Chem. Soc. 78, 1822-6(1956) May 5.

The equilibrium $2Ag + S_2O_3^{2-} = Ag_2S + SO_3^{2-}$ has been studied at 25, 122.5, and 195° and the heat of the reaction has been calculated from the temperature coefficient of the equilibrium constant. The heat of oxidation of $S_2O_3^{2-}$ to SO_4^{2-} by Br_3^- has been measured calorimetrically. From these data the following values are obtained for the heat of formation, free energy of formation, and partial molal entropy of $S_2O_3^{2-}$ at 298.16°K., $\Delta H_f° = -154.0$ kcal/mol, $\Delta F° = -122.7$ kcal/mol, and $\bar{S}° = 15.0$ eu. (auth)

8198

THE SOLUBILITY OF SILVER IODATE IN IODATE SOLUTIONS. IODATO COMPLEXES OF SILVER. James J. Renier and Don S. Martin, Jr. (Iowa State Coll., Ames). J. Am. Chem. Soc. 78, 1833-7(1956) May 5.

Solubilities of silver iodate at 25.0, 35.0, and 50.0°C have been measured by means of radioassay technique is aqueous solutions with various low concentrations of lithium iodate and with solutions having a constant ionic strength of 1.00M. Solubility product constants obtained for these temperatures were $(3.0 \pm 0.15) \times 10^{-8}$, $(6.3 \pm 0.3) \times 10^{-8}$, and $(17.4 \pm 1.0) \times 10^{-8}$, respectively. In addition to the normal equilibrium solubility product relationship, two complexing equilibria were needed to describe the behavior at higher iodate concentrations: $Ag^+ + IO_3^- \rightleftharpoons AgIO_3(aq.)$, for which $\Delta F°_{35°} = -1.13 \pm 0.18$ kcal/mol, $\Delta H°_{35°} = 5.1 \pm 4.5$ kcal/mol; $Ag^+ + 2IO_3^- \rightleftharpoons Ag(IO_3)_2^-$, for which $\Delta F°_{35°} = -2.53 \pm 0.04$ kcal/mol, $\Delta H°_{35°} = -5.20 + 0.79$ kcal/mol. (auth)

8199

STUDY OF SODIUM SULFATE–COBALT SULFATE, AND SODIUM SULFATE–NICKEL SULFATE SYSTEMS. K. A. Bol'shakov, and P. I. Fedorov (Lomonosov Inst. of Fine Chem. Technology). Zhur. Obshchei Khimii 26, 348-50(1956) Feb. (In Russian)

Studies are made of structural diagrams of $Na_2SO_4-CoSO_4$, and $Na_2SO_4-NiSO_4$. Intersolubility of components in the liquid state, formation of wide areas of solid solutions on the Na_2SO_4 side, and the presence of triple binary combinations of $3Na_2SO_4-MeSO_4$, $Na_2SO_4-MeSO_4$, and $Na_2SO_4-3MeSO_4$ (where Me = Ni and Co) were observed in both systems. (R.V.J.)

8200

THE ISOTOPIC EXCHANGE OF ARSENIC TRICHLORIDE AND CHLORINE. J. Harding Owens and Rowland E. Johnson (Florida State Univ., Tallahassee). J. Inorg. and Nuclear Chem. 2, 260-2(1956) Apr.

The rate of exchange of isotopic chlorine between $AsCl_3$ and Cl_2 in CCl_4 solution was measured. Results indicate that the exchange is catalyzed by HCl and that the formation of $AsCl_5$ is unlikely. (auth)

8201

SOME RELATIONSHIPS AMOUNG THE STABILITIES OF METAL COMPLEXES. Harry Irving and Hazel Rossotti (Inorganic Chemistry Lab., Oxford, England and Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 10, No. 1, 72-93(1956).

8202

THE EXPLOSIVE OXIDATION OF DIBORANE. Walter Roth and Walter H. Bauer (Rensselaer Polytechnic Inst., Troy, N. Y.). J. Phys. Chem. 60, 639-41(1956) May.

Studies on the oxidation of diborane at the second pressure explosion limit have been extended. The effects of the addition of varying amounts of N_2, He, A, and H_2 to the stoichiometric mixture have been investigated. The results are shown to support a reaction mechanism involving bimolecular chain branching and trimolecular chain breaking. The gases, N_2, He, and A are shown to act as third bodies in excellent agreement with their behavior predicted by collision theory. The results of hydrogen addition indicate that the

reaction $BH_3 + B_2H_6 \rightarrow B_3H_7 + H_2$ occurs to a small extent, and that there is a competition between the reactions $O + B_2H_6 \rightarrow BH_2OH + BH_3$ and $O + H_2 \rightarrow OH + H$ for the removal of oxygen atoms. (auth)

8203

THERMAL DIFFUSION IN LIQUIDS; THE EFFECT OF NON-IDEALITY AND ASSOCIATION. L. J. Tichacek, W. S. Kmak, and H. G. Drickamer (Univ. of Illinois, Urbana). J. Phys. Chem. 60, 660-5(1956) May.

It is shown that the thermodynamics of irreversible processes, when appropriately applied to a system fixed in the laboratory, predicts that a thermal diffusion separation depends on the difference in the quantities Q_i^*/V_i, where Q_i^* is the molal net heat of transport and $\bar{V}_i$ is the partial molar volume. Q_i^* is related to the activation energy for motion by a physically logical argument and by a kinetic derivation. The results are applied to a series of binary solutions including one or more associated compounds. It is found that the activation energy for local expansion, $\Delta H \ddagger$, is probably the part transported in molecular diffusion. The introduction of the "partial molar activation energy" is shown to predict the correct concentration dependence in thermal diffusion. The role of X $(\partial\mu/\partial X)$ in thermal diffusion is discussed. (auth)

8204

PREPARATION OF PURE NICKEL BY ELECTROLYSIS OF A CHLORIDE SOLUTION. W. A. Wesley (International Nickel Co., Inc., Bayonne, N. J.). J. Electrochem. Soc. 103, 296-300(1956) May.

Pure nickel was prepared in the form of malleable electrodeposited sheets as thick as 6 mm from purified nickel chloride-boric acid solution using iridium–platinum alloy anodes. The over-all reaction is $NiCl_2 = Ni(metal) + Cl_2(gas)$. As electrolysis proceeded, purified chloride solution was added automatically to maintain the metal content of the electrolyte. The total of spectrographically detectable impurities is estimated to be about 34 ppm. Carbon content of 26 ppm was reduced to 9 ppm by heating the metal in tank hydrogen and it is believed that any hydrogen, oxygen, and chlorine in the nickel were also substantially reduced by this treatment. (auth)

8205

ISOTOPIC EXCHANGE OF CARBON BETWEEN THE SOLID CARBONATES OF LITHIUM, SODIUM, POTASSIUM, AND BARIUM, AND GASEOUS CARBON DIOXIDES. V. A. Shushunov and B. G. Zateev (Gor'kiĭ State Univ.). Zhur. Fiz. Khim. 30, 321-8(1956) Feb. (In Russian)

Investigations were made of carbon isotope exchange between solid carbonates of Li, Na, K, and Ba and gaseous CO_2 under flow conditions. It was established that the rate of reaction depends on the method of preparing the solid carbonates but does not depend on the air and water vapor impurities in the gas. The reaction is of zero order in respect to carbon dioxide. The reaction proceeds at a noticeable rate at 300° and becomes rapid at 350 to 400°. (tr-auth)

AEROSOLS

8206

THE REFRACTIVE INDEX OF COLLOIDAL SOLS. Adam Chou and Milton Kerker (Clarkson Coll. of Tech., Potsdam, N. Y.). J. Phys. Chem. 60, 562-4(1956) May.

The refractive index of sulfur hydrosols of various particle sizes has been measured and the intrinsic refractive index computed. The experimental values are in agreement with the requirements of the Zimm-Dandliker theory. (auth)

ANALYTICAL PROCEDURES

8207 AECL-298

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

SPECTROCHEMICAL ANALYSIS OF PLUTONIUM. G. Zotov and C. A. Fowler. May 3, 1955. 32p.

A procedure for the spectrochemical analysis of plutonium for impurity content is described. Graphite electrodes are used to support sample material as dried residue. A sparking technique is used for the excitation of the electrodes which are enclosed in a special container designed to prevent radioactive contamination. Oxygen atmosphere reduces the background due to carbon and cyanogen. Techniques of preparation of standards and samples, loading of electrodes, plate calibration and internal standardization are described. Limits of detection, reproducibility and accuracy are discussed. Illustrations are given of equipment used and spectra obtained. (auth)

8208 AECU-3273

Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.

THE DETERMINATION OF HYDROGEN GAS IN WATER BY THE METHOD OF THERMAL CONDUCTIVITY. Research Report 60-94602-9-R5. J. H. Lady and W. B. Brozda. Mar. 2, 1956. $3.30(ph OTS); $2.40(mf OTS).

A rapid method for the determination by means of thermal conductivity of H gas dissolved in water is described. A sample of water containing the H was passed into a H_2SO_4 bath which served as a dehydrating agent. The H was subsequently swept from the acid solution into a thermal conductivity unit by a stream of N which served as the carrier gas. The sample size generally used for water saturated with H was ½ mil; however, as little as 0.1 mil of saturated water gives adequate response for a determination. No interferences were encountered in this method even though the sample was exposed to the atmosphere. An estimated standard deviation of 1.6 ml of H per liter of water was obtained when employing a device for tapping off a constant volume sample from a reservoir. An estimated standard deviation of 2.3 ml of H per liter of water was obtained for samples injected directly into the system with a hypodermic syringe. These standard deviations were obtained using ½ ml samples of H-saturated water. (auth)

8209 AERE-C/R-1927

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE ANALYSIS OF HEAVY WATER. F. J. Bryant. Mar. 1956. 19p.

8210 AWRE-0-7/53

Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.

THE COLOURIMETRIC ESTIMATION OF A NON-IONIC DETERGENT. D. G. Stevenson. Sept. 17, 1953. 8p.

Sulfuric-acid and molybdenum-thiocyanate procedures for the colorimetric determination of non-ionic detergents are described. In each procedure, the detergent is initially separated by precipitation with phosphomolybdic acid. (C.W.H.)

8211 DP-161

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

DETERMINATION OF MICROGRAM AMOUNTS OF ZIRCONIUM IN URANYL NITRATE SOLUTIONS. Edwin R. Russell. May 1956. 7p. Contract AT(07-2)-1. $0.15 (OTS).

A colorimetric method was developed for the deter-

mination of one to ten micrograms of Zr in uranyl nitrate solutions. Samples containing one microgram of Zr and 400 milligrams of U were analyzed successfully. (auth)

8212 ISC-737

Ames Lab., Ames, Iowa.

ANNOTATED BIBLIOGRAPHY OF 1,2-CYCLOHEPTANEDIONEDIOXIME. Charles V. Banks and Howard B. Nicholas. June 14, 1956. 10p. Contract W-7405-eng-82. $0.15(OTS).

Analytical procedures for the determination of Ni by 1,2-cycloheptanedionedioxime are annotated. (W.L.H.)

8213 KAPL-1539

Knolls Atomic Power Lab., Schenectady, N. Y.

THE SPECTROGRAPHIC ANALYSIS OF ZIRCONIUM AND HAFNIUM. D. A. Del Grosso and F. P. Landis. May 15, 1956. 52p. Contract W-31-109-Eng-52. $0.35(OTS).

Spectrographic methods are presented for the determination of 31 metallic impurities in Zr, Zr alloys, and hafnium. The methods described include: two carrier-distillation direct-current arc methods for the determination of most of the impurities, a 2200-volt alternating-current arc method for the determination of tungsten, and a high-amperage direct-current arc method for Hf/Zr ratios. As developed, the first two methods are semi-quantitative. That is, the results are probably accurate within ±50% of the amount of impurity reported. The determinations of tungsten and of Hf/Zr ratios, however, are internal standard methods based on the intensity of a matrix line and are more precise. (auth)

8214 AEC-tr-2547

A NEW MICROCHEMICAL COMPLEX AND ITS APPLICATION TO THE STUDY OF Cu^{++}. Juan Carlos Baró Graf. Translated by K. Bevis from Mikrochim. Acta, Nos. 1 to 3, 263-7(1956). 4p.

A practically saturated solution of salicylic acid in pyridine is a good reagent for identifying Cu^{2+}. The resulting complex was determined to be a copper-pyridine-salicylate. (W.L.H.)

8215 AEC-tr-2548

COMPLEX IONS. IX. TITRATION OF METALS WITH ETHYLENEDIAMINE TETRAACETIC ACID H_4Y. END POINT INDICATION BY pH EFFECTS. G. Schwarzenbach and W. Biedermann. Translated by K. Bevis from Helv. Chim. Acta 31, 459-65(1948). 7p.

Three methods for titrating metals are described by which the formation of a complex with ethylenediamine tetraacetic acid is analyzed. (auth)

8216 AERE-Lib/Trans-576

CONTRIBUTIONS TO THE CHROMOTOGRAPHIC CONTACT PRINT METHOD. J. Chervet and R. Pierrot. Translated by L. D. Muller from Bull. soc. franc. mineral. et crist. 77, 611-30(1954). 15p.

The chromatographic-contact print technique has been used for the determination of Ni, Co, Cu, and Fe in Co and Ni ores and of U in U ores. (C.W.H.)

8217 AERE-Lib/Trans-633

APPLICATION OF THE ELECTROCHEMICAL DETERMINATION OF OXYGEN. F. Todt. Translated by R. J. Richardson from Angew. Chem. 67, 266-70(1955). 12p.

The application of the electrochemical determination of oxygen is reported. A brief discussion of the fields of application in which it has been successfully used so far shows that the method can be applied to meet the most widely divergent requirements. The principle of the electrochemical determination of oxygen depends on the fact that the current density of galvanic cells suitably arranged together can, under fixed experimental conditions, be employed for measuring exactly the oxygen dissolved in the electrolyte. The simplicity, rapidity (immediate reading off or automatic registering of the current), and undelayed detection of changes in oxygen concentration are most noticeable in comparison with the chemical determination of oxygen (e.g. by Winkler's method). (auth)

8218 TIB/T-4469

KNOWLEDGE OF THE BASIC AZIDES. I. THE BASIC LEAD AZIDES. (Zur Kenntnis der Basischen Azide. I. Die Basischen Azide des Blei.) W. Feitknecht and M. Sahli. Translated from Helv. Chim. Acta 37, 1423-31 (1954). 10p.

Three methods for preparing Pb azides are described. Basic lead azides were identified by x-ray diffraction. Their Pb and N_3 content was determined. (W.L.H.)

8219

ON THE QUANTITATIVE ESTIMATION OF BERYLLIUM. PART I. AS BARIUM FLUOBERYLLATE GRAVIMETRICALLY. R. K. Dutta and A. K. Sen Gupta (Univ. Coll. of Science, Calcutta). J. Indian Chem. Soc. 33, 146-8(1956) Feb.

A gravimetric method for the estimation of Be is described. Beryllium reacts with fluoride ion to form a BeF_4^{2-} ion, and when a Ba salt is added to this solution, it effects a quantitative precipitation of $BaBeF_4$. The pH of the solution was maintained at ~4. The formation of BaF_2 and the corroding action of HF on glass are prevented by addition of H_3BO_3. (auth)

8220

THE ANALYSIS OF COMPLEX MIXTURES OF ELEMENTS RESULTING FROM THE IRRADIATION OF FISSILE MATERIALS. E. A. C. Crouch and G. B. Cook (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 2, 223-8(1956) Apr.

An analytical scheme for the separation of complex mixtures of mainly fission-product elements on the semimicro scale is described. The method has been used by many operators, who have obtained satisfactory chemical yields of separated radiochemically pure carrier-borne and sometimes carrier-free nuclides and has proved successful even in the presence of gross quantities of foreign matter. (auth)

8221

KJELDAHL DIGESTION TECHNIQUES FOR HIGH TEMPERATURE MATERIALS. William Fall (Schwarzkopf Development Corp., Yonkers, N. Y.). Powder Met. Bull. 7, 88-9 (1956) Apr.

Digestion techniques successfully employed in the Kjeldahl method of N determination of TiC_2, TaC, ZrB_2, TiB_2, CrTi, CrN_2 and CoCr are explained. (F.S.)

8222

ANALYSIS OF MIXTURES OF THE CONDENSED PHOSPHATES BY ION-EXCHANGE CHROMATOGRAPHY. II. MIXTURES OF ORTHO-, PYRO-, TRI-, TETRA-, TRIMETA-, AND TETRAMETAPHOSPHATES AND GRAHAM'S SALT. Timothy V. Peters, Jr., and Wm. Rieman, III (Rutgers Univ., New Brunswick, N. J.). Anal. Chim. Acta 14, 131-5(1956) Feb.

8223

5:6-BENZOQUINALDINIC ACID AS AN ANALYTICAL REAGENT. I. DETERMINATION OF THORIUM AND ZIRCONIUM. Anil Kumar Majumdar and Siddheswar Banerjee (Coll. of Engineering and Tech., Calcutta, India). Anal. Chim. Acta 14, 306-10(1956) Apr.

Thorium and zirconium are determined in the presence of rare earths, alkaline earths and magnesium, when precipitated from weakly acid solution with 5:6-benzoquinaldinic acid. Thorium is completely precipitated at pH 3.0 as $Th(C_{14}H_8O_2N)_4$, but though zirconium is precipitated at the lower pH of 1.8, its composition is not stoichiometric and hence is ignited to the oxide before weighing. Co-precipi-

tation of magnesium and alkaline earths is prevented by the addition of ammonium chloride. (auth)

8224

AMPEROMETRIC TITRATION OF MOLYBDENUM. G. H. Aylward (Univ. of Technology, Sydney, Australia). Anal. Chim. Acta 14, 386-9(1956) Apr.

A method for the amperometric titration of molybdenum (VI) with lead nitrate solution is described. The precipitation is carried out at room temperature from an acid sodium acetate-potassium chloride supporting electrolyte. The diffusion currents are recorded at a potential of −0.8 V vs. S.C.E. where both the lead and molybdenum give reduction waves. While the reduction of molybdenum in acetic acid buffer produces no well defined plateau, it gives accurate and reproducible results amperometrically. The analytical precision is about 0.4%. (auth)

8225

HALF-WAVE POTENTIALS OF METAL IONS IN ORGANIC HYDROXYACID SUPPORTING ELECTROLYTES. I. Ernest J. Breda and Philip W. West (Louisiana State Univ., Baton Rouge) and Louis Meites (Polytechnic Inst. of Brooklyn) and Thomas B. Reddy (Yale Univ., New Haven, Conn.). Anal. Chim. Acta 14, 390-9(1956) Apr.

Eight new media containing organic hydroxyacids and their anions have been investigated as supporting electrolytes for polarographic analysis. For over 25 metal ions in each of these media there are tabulated the half-wave potentials, reversibilities and probable products of the electrode reactions, descriptions of the wave forms, and other data of polarographic importance. (auth)

8226

A MODIFIED ETHYLENEDIAMINETETRA-ACETIC ACID–TANNIC ACID PROCEDURE FOR THE DETERMINATION OF NIOBIUM, TANTALUM, AND TITANIUM TOGETHER IN MINERALS. M. Sankar Das, Ch. Venkateswarlu, and V. T. Athavale. Analyst 81, 239-42(1956) Apr.

Niobium, tantalum and titanium are quantitatively precipitated together and separated from most of the associated elements by tannic acid from oxalate solutions in the presence of ethylenediaminetetra-acetic acid at a pH of about 4·5. Tin and antimony interfere in the procedure by their quantitative precipitation. Methods of separation from these elements are indicated. Tungsten is partly thrown down in the presence of niobium, tantalum and titanium, but it has little effect when present in amounts less than 2%. Single precipitation gives a good separation, so that the method is straightforward and simple, while being applicable to a variety of minerals. (auth)

8227

A RAPID COLORIMETRIC DETERMINATION OF VANADIUM IN CARBON MATERIALS. Ken Sugawara, Motoharu Tanaka, and Akiya Kozawa (Nagoya Univ.). Bull. Chem. Soc. Japan 28, 492-4(1955) Sept.

8228

A NEW METHOD OF SPECTROPHOTOMETRIC DETERMINATION OF IODINE IN NATURAL WATERS. Ken Sugawara, Tadashiro Koyama, and Kikuo Terada (Nagoya Univ.). Bull. Chem. Soc. Japan 28, 494-7(1955) Sept.

8229

CALIBRATION AND FIELD USE OF THE NEUTRON SCATTERING METHOD OF MEASURING SOIL WATER CONTENT. J. W. Holmes (Waite Inst., Adelaide, Australia). Australian J. Appl. Sci. 7, 45-58(1956) Mar.

The method of measuring water content of soil by neutron scattering was studied with the intention of developing a convenient technique for calibration and field use. Neutron transport theory provides a basis for calculating a calibration curve expressed as counting rate vs. water content. The agreement between the computed curve and measured water contents is encouraging though further use of neutron theory involving some refinement and fewer simplifying assumptions would be desirable. An example is given of the use of the method for the measurement in situ of soil water content. The evaporation from the land surface was derived from a sequence of measurements and the technique promises to be most useful for research of this kind. (auth)

Refer also to abstracts 8333 and 8334.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

8230

PREPARATION AND SOME PROPERTIES OF $HAu(CN)_2$. R. A. Penneman, E. Staritzky, and L. H. Jones (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 78, 62(1956) Jan. 5.

DEUTERIUM AND DEUTERIUM COMPOUNDS

8231 A-335

Columbia Univ., New York. Div. of War Research.

THE DESIGN OF CASCADES FOR THE CONCENTRATION OF DEUTERIUM. Irving Kaplan and Karl Cohen. Oct. 19, 1942. Decl. May 14, 1954. 31p. Contract OEMsr-412. $6.30(ph OTS); $3.00(mf OTS).

An analytical theory of the design of cascades for the concentration of deuterium is worked out. The cascades considered are made up of stages, each consisting of an exchange tower and a bank of electrolytic cells. Section II deals with the operation of a single exchange tower of the Barr type. Section III contains an analysis of a single stage, i.e., of a tower in series with cells. The design of the cascade as a whole is developed in Section IV. The number of sections and the volume of catalyst in a tower are found as functions of temperature, percentage attainment of equilibrium per section and overall percentage recovery. Examples of the practical application of the theory, with special reference to the Trail plant, are given. (auth)

8232 CEI-73

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

HEAVY WATER PRODUCTION BY NATURAL WATER DISTILLATION. I. GENERAL CONSIDERATIONS. H. K. Rae. Oct. 1, 1954. 34p.

The economical production of heavy water by the distillation of natural water is discussed. A vapor compression cycle is suggested for heat recovery. Equipment requirements include grid-packed or wetted-wall distillation columns, inclined tube natural circulation evaporators, and an electric-motor-driven centrifugal compressor. (See also CEI-74.) (C.W.H.)

8233 NBS-3519

National Bureau of Standards. NBS-AEC Engineering Lab., Boulder, Colo.

A PRELIMINARY STUDY OF SOME ASPECTS OF A HEAVY WATER PLANT. Technical Memorandum No. 30. P. C. Vander Arend. Feb. 11, 1955. 20p. NBS Project 8102-20-8622. $0.25(OTS).

Most of the critical cryogenic problems surrounding the construction of a large heavy water plant based on the fractional distillation of liquid hydrogen and hydrogen deuteride have to a large extent been solved during the past few years. Efficient methods of handling liquid hydrogen in large quantities have been developed. Very efficient types of insulation are available and refrigeration at the 20°K temperature level can be obtained in a reliable and economical manner. The major problems of fractional distillation of liquid hydrogen and its isotopes have shifted

to column design. At the present time no engineering data for large-scale distillation are available. Without them minimum dimensions for a column cannot be calculated and consequently factors such as cool-down time, time required to obtain equilibrium, and amount of refrigeration required cannot be accurately determined. However, even with the few distillation data in existence it appears that fractional distillation of hydrogen isotopes provides a very efficient process for the production of heavy water or deuterium gas of high purity. It is felt that purification of the feed gas is a separate problem which should be considered in connection with potential supplies of raw feed gas. There are probably a number of potential sites for a heavy water plant in the United States, each one of which might require a purification system somewhat different from the others. Finally, the estimates made in this report indicate that electrical energy consumption per pound of heavy water will be of the order of 630 kwh. The product obtained from the column consists of 3% hydrogen deuteride and 97 percent hydrogen. Little additional energy is required to concentrate this product to essentially pure deuterium or heavy water. (auth)

8234

HOMOGENEOUS EXCHANGE REACTION BETWEEN HYDROGEN AND DEUTERIUM. G. Boato and G. Careri (Istituto di Fisicia dell' Universita, Rome) and A. Cimino, E. Molinari, and G. G. Volpi (Istituto di Chemica Generale ed Inorganica dell' Universita di Roma, Centro per la Chimica del C. N. R., Rome). J. Chem. Phys. 24, 783-91 (1956) Apr.

The homogeneous exchange reaction between H_2 and D_2 has been reinvestigated, to see whether a more satisfactory quantitative test of the transition state method could be obtained in this simple chemical reaction. The reaction was studied in the temperature range from 916 to 1010°K, where the heterogeneous contribution from the walls was found to be negligible. Preventing air from diffusing into the reaction vessel through the walls, exchange rates lower by a factor of 2.0 than those obtained by previous authors were found in the whole temperature interval. The total activation energy was determined as 59.8 ± 0.4 kcal/mol. The validity of the transition state method was tested by extrapolation of the experimental data to a lower temperature region (283 to 373°K) where independent experimental data were available. Comparison of the extrapolated values with the experimental ones leads to a very good agreement. (auth)

8235

ISOTOPIC EFFECTS AND COLLISIONAL DEACTIVATION IN THE MERCURY PHOTOSENSITIZED DECOMPOSITION OF ETHYLENE. A. B. Callear and R. J. Cvetanović (National Research Council, Ottawa, Canada). J. Chem. Phys. 24, 873-8(1956) Apr.

Mercury photosensitized decomposition of C_2H_4, C_2D_4, cis-$C_2D_2H_2$, and C_2H_4 with excess Xe added, has been investigated at room temperature. An isotopic effect in the intramolecular decomposition of ethylene has been established, as well as an extensive isotopic isomerization in the course of collisional deactivation of the energy rich molecules. The cis-dideuteroethylene isomerizes not only to the trans- but also to the anti-form. The experimental results are discussed in terms of the intramolecular decomposition and collisional deactivation of the excited molecules formed in the primary process. (auth)

8236

THE ADSORPTION OF DEUTERIUM BY A PLATINUM CATALYST. G. C. Bond (Princeton Univ., N. J.). J. Phys. Chem. 60, 702-3(1956) May.

The fraction of total adsorbed D_2 which is exchangeable with H_2 increased exponentially with the temperature. At 200°C, almost complete exchange of adsorbed D_2 was observed; at 0°C, an appreciable fraction did not exchange. (C.W.H.)

Refer also to abstracts 8209 and 8741.

FLUORINE AND FLUORINE COMPOUNDS

8237 NP-5942

Stanford Research Inst., Menlo Park, Calif.

THE THERMODYNAMIC PROPERTIES OF MOLTEN SALTS. Report No. 7. Bimonthly Progress Report for February–March 1956. Orlo E. Myers. Apr. 5, 1956. 8p. SRI Project No. CU-1102. Task No. 73017. Contract AF 33(616)-2558.

The objective of this study is to determine the absolute entropies, heats of formation, and free energies of formation of selected metallic fluorides in the temperature range of 800 to 1900°F. An electroformed nickel capsule to contain corrosive and hygroscopic fluorides for high-temperature calorimetry was constructed. Low-temperature heat capacity data for NbF_5 were prepared for machine computation. A drop-calorimeter installation is described for high-temperature heat capacity determinations. This apparatus lacks only the precision electrical connections and final adjustment for its completion. (auth)

8238 NP-5952

Florida. Univ., Gainesville.

PREPARATION OF FLUORINE CONTAINING COMPOUNDS. Quarterly Technical Report [for] Period February 1, 1956 to April 30, 1956. H. C. Brown, R. D. Dresdner, J. A. Wethington, Jr., and J. A. Young. 17p. Contract Nonr-580(03).

Research was continued on identification of amino acid derivatives, preparation and chemical reactions of fluoroalkyl sulfur fluorides, and preparation of perfluoroalkyl diamidines. Nuclear-magnetic-resonance and infrared spectral studies were carried out on several fluorine compounds. (C.W.H.)

8239 AEC-tr-2538

DETERMINATION OF DECOMPOSITION POTENTIALS OF MOLTEN FLUORIDES OF ALKALINE AND ALKALINE EARTH METALS. Yu. K. Delimarskii and F. F. Grigorenko. Translated from Ukrain. Khim. Zhur. 21, 561-8(1955). 17p.

An electrochemical series of metals in molten fluorides was established at 1000°C and at temperature of fusion. Methods for determining the decomposition potentials of molten salts were presented. It was hypothesized that decomposition potentials depend on the magnitude of the ion radii. (W.L.H.)

8240

THE HYDRATES OF ZIRCONIUM TETRAFLUORIDE. R. W. M. D'Eye, J. P. Burden, and E. A. Harper (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 2, 192-5(1956) Mar.

A mono- and a trihydrate of ZrF_4 have been identified from x-ray diffraction and chemical studies. The monohydrate is body-centred tetragonal with a = 7.70 ± 0.01kX and c = 11.63 ± 0.01kX and 8 molecules per unit cell. The trihydrate degrades to the monohydrate at 100°C in air, and at room temperature in vacuo. The monohydrate when heated in air at 250°C degrades to the oxide and/or oxyfluoride, and in vacuo decomposes to an unidentified substance. (auth)

8241

A NEW METHOD FOR PRODUCING PERCHLORYL FLUORIDE (ClO_3F). Gerhard Barth-Wehrenalp (Penna. Salt Mfg.

Co., Wyndmoor). J. Inorg. and Nuclear Chem. 2, 266(1956) Apr.

Perchloryl chloride, ClO_3F, can be prepared by the reaction of potassium perchlorate with fluosulfonic acid at 85°C. Carbon dioxide and air were the only impurities found in the product. (C.W.H.)

8242

REACTION HEATS OF ORGANIC HALOGEN COMPOUNDS. V. THE VAPOR PHASE BROMINATION OF TETRAFLUOROETHYLENE AND TRIFLUOROCHLOROETHYLENE. J. R. Lacher, Liberty Casali, and J. D. Park (Univ. of Colorado, Boulder). J. Phys. Chem. 60, 608-10(1956) May.

The heat of formation of HBr was calculated to be -12.377 ± 0.130 kcal/mol at 25°C. Values obtained for the vapor phase heats of bromination of tetrafluoroethylene and trifluorochloroethylene were -38.478 and 31.608 kcal/mol at 103°C, respectively. (auth)

8243

PURIFICATION OF PERFLUORO-n-HEPTANE AND PERFLUOROMETHYLCYCLOHEXANE. D. N. Glew and L. W. Reeves (Univ. of California, Berkeley). J. Phys. Chem. 60, 615(1956) May.

Ultraviolet absorption reveals the presence in these substances of impurities not removed by fractional distillation. A method of purification is described whereby the optical density of both was reduced to 0.2 at 200 mμ. Their densities at 25° are: n-C_7F_{16} 1.72006; cyclo-$C_6F_{11}CF_3$ 1.78777, both higher than any previously reported. Their boiling points are 82.34 and 76.14°, respectively, and their vapor pressures are reproduced by the respective equations: log p = 1824/T + 8.0166 and log p = 1740.7/T + 7.8645. (auth)

8244

THE SOLUBILITY AND PARTIAL MOLAL VOLUME OF IODINE IN PERFLUORO-n-HEPTANE. D. N. Glew and J. H. Hildebrand (Univ. of California, Berkeley). J. Phys. Chem. 60, 616-18(1956) May.

The solubility of I_2 in perfluoro-n-heptane has been redetermined with great care between -11.6 and 65°. Its mole fraction is given by the equation: log x_2 = -2,246.2/T + 3.7886. At 25°, $x_2 = (1.799 \pm 0.001) \times 10^{-4}$. For the process I_2 solid to saturated solution, ΔH = 10,274 cal/mol, and ΔS = 34.39 cal/deg/mol. The partial molal volume of I_2 in the nearly saturated solution is 100 ml/mol. (auth)

8245

THE ENTROPY OF SOLUTION OF IODINE. J. H. Hildebrand and D. N. Glew (Univ. of California, Berkeley). J. Phys. Chem. 60, 618-20(1956) May.

The entropy of solution of a solid can be determined from the change of solubility with temperature by the equation $\bar{S}_2 - S_2^s = R\left(\frac{\partial \ln a_2}{\partial \ln x_2}\right)\left(\frac{\partial \ln x_2}{\partial \ln T}\right)_{sat}$. A plot of $R(\partial \log x_2/\partial \log T)_{sat}$ vs. $-\log x_2$ for iodine solutions at 25° shows all the points for violet regular solutions on a single straight line, and those for irregular solutions below it. This constitutes a sensitive test. The line is higher and steeper than the theoretical line for ideal solutions. The displacement is explained by three factors, a departure from Henry's law, the entropy of mixing at constant volume molecules of different size, and the entropy of expansion. The latter two are very large in the solution in n-f-heptane. (auth)

8246

THE HEAT CAPACITY OF GASES AT LOW PRESSURE USING A WIRE-RIBBON METHOD. William N. Vanderkooi and Thomas De Vries (Purdue Univ., Lafayette, Ind.). J. Phys. Chem. 60, 636-9(1956) May.

A wire-ribbon method was developed for determining the accommodation coefficients and heat capacities of gases in the micron of mercury pressure region, and equations for the power dissipations of the wire and ribbon were derived. The heat capacities at constant volume and 300°K. of CHF_3, $CClF_3$, and CH_3CF_3 were found to be 10.23 ± 0.13, 14.10 ± 0.38, and 16.83 ± 0.18 cal/mol/deg., respectively; and by comparison with spectroscopic data the barrier hindering the internal rotation of CH_3CF_3 was established to be 3370 cal/mol. (auth)

8247

FLUOROCARBON SOLUTIONS AT LOW TEMPERATURES. I. THE LIQUID MIXTURES CF_4-CHF_3, CF_4-CH_4, CF_4-Kr, CH_4-Kr. N. Thorp and R. L. Scott (Univ. of California, Los Angeles). J. Phys. Chem. 60, 670-3(1956) May.

The liquid-liquid binary systems, CHF_3-CF_4, CHF_3-C_2F_6, CF_4-CH_4, CF_4-Kr, and CH_4-Kr, have been studied at low temperatures (105 to 140°K.). Fluoroform is completely miscible with perfluoroethane but forms two phases with perfluoromethane below a consolute temperature of 130.5°K. These results are in reasonable agreement with solubility parameter theory; the polar fluoroform has a much higher cohesive energy density than the fluorocarbons. The vapor pressures of methane-krypton, methane-perfluoromethane and krypton-perfluoromethane mixtures have been measured at temperatures near 110°K. The first system is nearly ideal, in agreement with the small difference in solubility parameters, but the latter two systems show abnormally large positive deviations from Raoult's law, much greater than can be explained easily. The anomalous deviations in the CH_4-CF_4 mixture are analogous to those found previously in other fluorocarbon-hydrocarbon systems, but the similar behavior of the CF_4-Kr system was completely unexpected. (auth)

8248

SOLUBILITIES OF IODINE AND PHENANTHRENE IN HYDROFLUOROCARBONS. Edward P. McLaughlin and Robert L. Scott (Univ. of California, Los Angeles). J. Phys. Chem. 60, 674-6(1956) May.

1-Hydroperfluoroheptane and 1,8-dihydroperfluoroöctane were prepared and their vapor pressures over a range 25 to 50° were measured. Heats of vaporization, dipole moment, densities, and refractive indices were determined at 25°. From these data, a solubility parameter of 6.3 was calculated for both liquids. The solubilities of I_2 and phenanthrene in $C_8F_{16}H_2$ were measured at 25° and were found to be in reasonable agreement with the solubility parameters. The solubilities of these solutes in $C_7F_{15}H$ fit better with δ = 5.7 for the solvent. Phenanthrene does not show in these solvents the anomalous solubility previously reported in fluorochemicals containing no hydrogen. (auth)

8249

THE COMPLEXING OF IRON(III) BY FLUORIDE IONS IN AQUEOUS SOLUTION: FREE ENERGIES, HEATS AND ENTROPIES. R. E. Connick, L. G. Hepler, Z. Z. Hugus, Jr., J. W. Kury, W. M. Latimer, and Maak-Sang Tsao (Univ. of Calif., Berkeley). J. Am. Chem. Soc. 78, 1827-9(1956) May 5.

The potential of the Fe^{2+}-Fe^{3+} half-cell has been studied as a function of HF concentration at 15, 25, and 35°. Equilibrium quotients and free energy, heat, and entropy changes at an ionic strength of 0.50 are calculated for the reactions: $Fe^{3+} + HF = FeF^{2+} + H^+$, $FeF^{2+} + HF = FeF_2^+ + H^+$, and $FeF_2^+ + HF = FeF_3 + H^+$. (auth)

GRAPHITE

8250 NAA-SR-1591

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

LOW-TEMPERATURE THERMAL AND ELECTRICAL CONDUCTIVITY OF GRAPHITE. II. INTERPRETATION.

John E. Hove and Alan W. Smith. Aug. 1, 1956. 30p. Contract AT-11-1-GEN-8. $0.25(OTS).

The experimental data observed in measuring the low-temperature thermal conductivity of several types of graphites are interpreted on the basis of a two-medium theory. This theory assumes that in the artificial polycrystalline graphites, the nongraphitic regions are isotropic thermal conductors, and that these regions can be taken in series with the graphite particles to obtain a total conductivity. In this way, the anomalous temperature dependence of the artificial graphites, mentioned in the preceding paper, can be immediately explained. Using this theory as a guide, the crystallite size of a given sample can be found in an unambiguous manner, and for the various graphite types discussed in the preceding paper, the crystallite sizes are found to correlate with independent previous estimates. Furthermore, the observed effects of neutron damage and bromination can be readily explained in a phenomenological manner. Although this theory still needs refining in several aspects, it appears to be substantiated by all the available evidence and helps to establish the usefulness of low-temperature thermal-conductivity measurements as a probe to detect internal defects and microstructure in graphite. (auth)

8251 WADC-TR-54-491

Stanford Research Inst., Menlo Park, Calif.

INVESTIGATION OF CARBON (GRAPHITE) BASE MATERIALS SUITABLE FOR ROCKET AND RAM-JET APPLICATIONS. Period Covered: April 1953 to September 1954. William D. Smiley. Aug. 1955. 50p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF 33(616)-2023.

The details of the preparation, application, and testing of high temperature, oxidation and erosion resistant materials for nozzles are reported. A composition whose starting components were 4 mol % Mo–52 mol % Si–44 mol % C and which was prepared from a mixture of 75 wt. % SiC and 25 wt. % $MoSi_2$, has shown promising high temperature properties, including good oxidation resistance and refractoriness. Solid nozzles have been prepared from this material, together with liners for graphite nozzles, for testing at the WADC rocket test station. (auth)

8252

TRACER STUDIES ON RADIATION DAMAGED GRAPHITE. G. Montet, G. Hennig, and A. Kurs (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 1, 33-52(1956) Mar.

The distribution of displaced carbon atoms in irradiated graphite has been studied with a radioactive tracer technique. Radiation-damaged graphite containing radioactive displaced carbon (C^{11}) atoms was prepared by cyclotron or betatron irradiation. After partial annealing, the distribution of the C^{11} was determined by controlled oxidation and counting of CO_2 gas samples. Experiments on various types of weakly irradiated graphite indicate that a very small fraction of the displaced atoms are driven to particle surfaces during the annealing process, the fraction being higher for natural graphite than for artificial graphite and varying inversely with graphite particle size. Experimental conditions were varied to determine their effects on the distribution of the displaced atoms. Data obtained indicate that very little reintegration of displaced atoms occurs during short neutron bombardments at room temperature, that about 80% of the atoms reintegrate into vacancies during annealing below 400°C and that the remainder coalesce into complexes, and that large scale motion of the complexes begins at 400°C and ceases at approximately 1000°C. At this latter temperature the complexes appear to reach their final positions; however, they are relatively loosely bound and integrate progressively at these sites until they become indistinguishable from lattice atoms near 1700°C. Vacancies resulting from prior irradiation were found by tracer experiments to be effective traps for displaced atoms so that, during annealing of subsequent damage, the fraction that reaches the particle surfaces decreases rapidly with bombardment. (auth)

8253

THEORY OF THE LATTICE VIBRATION OF GRAPHITE. Akio Yoshimori and Yoshiharu Kitano (Univ. of Osaka Prefecture, Sakai, Japan). J. Phys. Soc. Japan 11, 352-61 (1956) Apr.

A theory of the lattice vibration and specific heat of graphite, which has a typical lamellar structure, is worked out using the Born-von Karman method. Four types of restoring forces are assumed; the first and second ones are associated with changes in the bond lengths and bond angles of the honey-comb net planes, respectively, the third with change in distance between neighboring atoms on adjacent net planes, and the fourth with the bending of the net planes. Modes were obtained whose polarizations are parallel and perpendicular to the planes. The former are essentially two-dimensional, but the latter are of more complex characters and play a particular role in the temperature range 45 to 100°K. As the main interest is in this and higher temperature ranges, the shearing forces between neighboring net planes which are effective at much lower temperatures are neglected. For small wave numbers, this theory naturally reduces to the semi-continuum theory developed by Komatsu and Nagamiya (1951) and Komatsu (1955). The calculated specific heat curve is in good agreement with the one observed by DeSorbo (1954) in the temperature range 45 to 300°K. It is concluded that the discrepancy found by Komatsu at temperatures higher than 60°K between his theoretical values of the specific heat and the observed ones is due to the failure of his semi-continuum treatment. (auth)

LABORATORIES AND EQUIPMENT

Refer also to abstract 8522.

MOLECULAR STRUCTURE

8254

PROTON CONDUCTANCE AND THE EXISTENCE OF THE H_3O^+ ION. B. E. Conway, J. O'M. Bockris, and Hedda Linton (Univ. of Penna., Philadelphia and Imperial Coll., London). J. Chem. Phys. 24, 834-50(1956) Apr.

Measurements of the conductance of HCl in water, methanol, ethanol, n-propanol, ethylene glycol, glycerol, 1:4 dioxane, acetone, formic, and acetic acids and the respective aqueous-nonaqueous systems have been made as a function of concentration of water and HCl. The degree of anomalous proton conductance decreases with increasing n in C_nH_{2n+1} OH, and conductance minima occur in aqueous alcoholic HCl solutions of low H_2O content. Former theories of proton conductance have permitted no quantitative distinction to be made between the rates of classical proton transfer, quantum-mechanical tunneling transfer, and water rotation as rate determining stages. If resonance in H_3O^+ is set up sufficiently quickly after arrival of a given proton at a water molecule, rotation of H_3O^+ cannot be a rate determining step. Detailed calculations of the rates of classical proton transfer, tunnel transfer, and the rate of rotation of water are made. Classical transfer is much slower and tunnel transfer much faster than corresponds to the observed proton mobility; rotation of hydrogen bonded water molecules near the H_3O^+ ion is the rate determining

reaction (preceded and succeeded by fast tunneling of protons). This conclusion is quantitatively consistent with the OH' mobility in water, and the H^*/D^* mobility ratio and qualitatively consistent with pressure and temperature effects and with the absence of abnormal mobility of NH_4^* and NH_2' in liquid NH_3. A detailed interpretation of the dependence of abnormal conductance upon chain length in ROH gives fair quantitative agreement with experiment. The conductance minima observed in aqueous alcoholic HCl are quasi-quantitatively predicted by the theory. The proton spends about 1% of its time undergoing tunnel transfers; the effective existence of the H_3O^* ion is thus confirmed. (auth)

8255

NATURE OF THE HYDROGEN BOND. III. THE MEASUREMENT OF THE INFRARED ABSORPTION INTENSITIES OF FREE AND HYDROGEN-BONDED OH BANDS. THEORY OF THE INCREASE OF THE INTENSITY DUE TO THE HYDROGEN BOND. Hiroshi Tsubomura (Tokyo Inst. of Tech., Japan). J. Chem. Phys. 24, 927-31(1956) May.

The integrated intensities of the infrared OH bands of various compounds have been measured for the free and the hydrogen-bonded states. It is found that the integrated intensity of either the free or the hydrogen-bonded OH band increases as the frequency decreases. It is concluded that the main factor increasing the integrated intensity of the intermolecularly hydrogen-bonded OH bands is the charge transfer through the hydrogen bond. The sign of the change of the dipole moment of the free phenol with the OH distance is discussed. An explanation is given for the weakness of the OH bands of the chelate compounds. (auth)

8256

STUDY OF TWO-CENTER INTEGRALS USEFUL IN CALCULATIONS ON MOLECULAR STRUCTURE. IV. THE AUXILIARY FUNCTIONS $C_{\alpha\beta}^{\gamma\delta\epsilon}(\rho_a,\rho_b)$ FOR $\alpha \geq 0$. C. C. J. Roothaan (Univ. of Chicago). J. Chem. Phys. 24, 947-60(1956) May.

A new method is developed for the numerical computation of the auxiliary functions $C_{\alpha\beta}^{\gamma\delta\epsilon}(\rho_a,\rho_b)$ which were used in preceding calculations for the case $\alpha \geq 0$. The present method is suitable for all values of the parameter $\tau = (\rho_a - \rho_b)/(\rho_a + \rho_b)$, avoiding the excessive loss of significant figures which occurs in the methods previously developed for the physically important case of small τ. (auth)

8257

DETECTION OF FREE RADICAL ABSORPTION SPECTRA BY CHEMICAL MODULATION. Edward J. Bair, John T. Lund, and Paul C. Cross (Univ. of Washington, Seattle). J. Chem. Phys. 24, 961-5(1956) May.

A method is described for studying free radicals by absorption spectroscopy. The principal feature is the maintenance of an oscillating free radical concentration, which takes advantage of the high momentary concentrations that follow pulses of energy, and yet may be integrated to provide a continuous free radical absorption signal. The problems of detecting absorption in these transient systems are discussed using NH_2 generated by an electrical discharge through ammonia as an example. (auth)

8258

THERMAL EXPANSION AND STABILITY OF LAYER STRUCTURES IN IONIC AB COMPOUNDS. M. A. Bredig (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 24, 1037-40(1956) May.

Thermal expansion in PbO, SnO, or LiOH, in which single layers of O^{2-} or Li^+ alternate with double layers of Pb^{2+}, Sn^{2+}, or $(OH)^-$, respectively, is relatively small normal to the layers (c-axis). This "anomaly" is related to asymmetrical dilatation of the polarizable Pb^{2+}, Sn^{2+} in the field of O^{2-} anions, or, respectively, to elongation of $(OH)^-$ in the field of Li^+: When the cation-anion distance increases with temperature, the resulting decrease in these deformations reduces the spacing between the layers of like polarizable ions and the effective thermal expansion. Structures of this type are not stable for AB compounds if the polarized ion is the anion, but are if it is the cation: As cation polarizability increases with polarization, asymmetric, one-sided coordination of polarizing anions occurs, the energy being further lowered by dispersion forces acting between dilated cations. On the contrary, anions tightened by cations approach the behavior of rigid ions in coordinating cations more symmetrically in three-, rather than two-dimensional networks. (auth)

RADIATION CHEMISTRY

8259 ORNL-2136

Oak Ridge National Lab., Tenn.

IONIZATION OF ACETYLENE MIXTURES AND OTHER MIXTURES BY Pu^{239} ALPHA PARTICLES. Harold J. Moe. Aug. 14, 1956. 51p. Contract W-7405-eng-26. $0.35 (OTS).

W values (average energy expended by an α particle in creating an ion pair in gas) were determined for mixtures of acetylene with He, A, Ne, CO_2, N_2, and C_6H_6 using 5.14-Mev particles. The estimated W value of C_6H_6 is 27.5 ± 0.3. (C.W.H.)

8260

THE RADIATION CHEMISTRY OF HYDROCARBON POLYMERS: POLYETHYLENE, POLYMETHYLENE, AND OCTACOSANE. A. A. Miller, E. J. Lawton, and J. S. Balwit (General Electric Research Lab., Schenectady, N. Y.). J. Phys. Chem. 60, 599-604(1956) May.

Polymethylene, polyethylene, and octacosane were irradiated with high-energy (800 kev) electrons and crosslinking, changes in unsaturation, and gas evolution were measured. The only type of unsaturation formed is trans-vinylene and this is produced in approximately equal yields in all three hydrocarbons. About 40% of the hydrogen evolved comes from this reaction, the remainder arising from crosslinking. Volatile hydrocarbons result from C–C scissions near the chain-ends and also at the short branches in polyethylene. The results indicate that in the unbranched hydrocarbons, polymethylene and octacosane, permanent C–C scissions do not occur at random throughout the hydrocarbon chain. In polyethylene the evidence is not as clear but the tentative conclusion is that some main-chain cleavage leading to methyl end-groups may occur. Radiation yields (G values) for crosslinking, vinylene unsaturation, and gas evolution, and a general mechanism for crosslinking of these hydrocarbon structures are presented. (auth)

8261

RATE OF RECOMBINATION OF RADICALS. I. A GENERAL SECTOR THEORY; A CORRECTION TO THE METHYL RADICAL RECOMBINATION RATE. Allan Shepp (National Research Council, Ottawa, Canada). J. Chem. Phys. 24, 939-43(1956) May.

A rotating sector theory applicable to simple photochemical decompositions involving both first-order and second-order removal of radicals was derived. This theory gives the behavior of radicals under intermittent illumination as a function of two parameters: α, the ratio of first- to second-order removal rates, and β, a function of flash time. The methyl radical recombination rate was recalculated and the new value obtained for the rate constant was 2.2×10^{13} ml/mole/sec in the temperature range 125 to 175°C. (auth)

8262

RATE OF RECOMBINATION OF RADICALS. II. THE RATE OF RECOMBINATION OF TRIFLUOROMETHYL

RADICALS. P. B. Ayscough (National Research Council, Ottawa, Canada). J. Chem. Phys. 24, 944-6(1956) May.

The rotating sector technique has been used to determine the rate of recombination of trifluoromethyl radicals produced by the vapor phase photolysis of hexafluoroacetone. Using the method of calculation described in [J. Chem. Phys. 24, 934-43(1956) May] the rate constant was found to be 2.3×10^{13} ml/mol/sec at 127°C. (auth)

8263

LUMINESCENCE OF ICE SUBJECTED TO IONIZING RADIATION. J. A. Ghormley (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 24, 1111-12(1956) May.

Spectral distributions of thermoluminescence and fluorescence in γ-irradiated ice at −196 to −115°C are reported. The emission at −155°C was found to be 90% ultraviolet while emission at −115°C was nearly all in the visible region. (C.W.H.)

8264

ACTIVITY RATIOS OF THE Br^{80} ISOMERS, STUDIED BY MEANS OF AN ALUMINA ADSORPTION PROCESS. D. J. Apers and P. C. Capron (Univ. of Louvain, Belgium). J. Inorg. and Nuclear Chem. 2, 219-22(1956) Apr.

Experiments on neutron-irradiated n-propyl bromide, which was purified by adsorption on alumina, indicate different chemical behavior of the two Br^{80} isomers. This difference is shown in the activity ratios of the two isomers in the unwashed material and in the washed product obtained by passing the bromide through an alumina column. (auth)

8265

RADIATION INDUCED LUMINESCENCE. PART 2. THE EFFECT OF OXYGEN AND BROMOBENZENE. P. J. Berry, S. Lipsky, and M. Burton (Univ. of Notre Dame, Ind.). Trans. Faraday Soc. 52, 311-30(1956) Mar.

The quenching effect of O_2 and bromobenzene on the Co^{60} γ-induced luminescence of p-terphenyl in benzene has been studied as a function of the p-terphenyl concentration. In addition, the effects of O_2 and bromobenzene on the scintillator systems of m-terphenyl in benzene and in cyclohexane, of p-terphenyl in cyclohexane and in toluene, and of 1.4-diphenylbutadiene in cyclohexane and in benzene have been studied. The results are interpreted on the basis of electronic energy transfer (via emission of virtual photons) from excited solvent molecules to scintillator molecules. The quenching of the luminescence is shown to be almost completely attributable to an interaction between the quencher and excited solvent molecules. The efficiency of quenching remains constant with increasing bromobenzene concentration up to the highest concentrations studied (≈0.1M). For O_2, the quenching efficiency shows, in general, a small increase with increasing O_2 pressure. This deviation can be attributed both to a slight quenching of the excited state of the scintillator and to a "static" quenching effect. In most systems studied, the rate constant for quenching of the solvent is approximately the same as the rate constant for transfer of energy from the solvent to the scintillator. An alternative mechanism to explain the high-energy-induced luminescence involving ionic species is briefly considered. (auth)

RADIATION EFFECTS

8266 MLM-CF-55-8-22

Monsanto Chemical Co., St. Louis.

MONTHLY PROGRESS LETTER NO. 11. Summary Report—June 25, 1955 to July 25, 1955. Malcolm McEwen. Aug. 1, 1955. Decl. Mar. 23, 1956. 25p. Contract NObs-66067.

A summary of the data on the operation of and radiation effects on the diphenyl test loop in the BNL reactor is reported. (J.E.D.)

8267 NP-5929

Monsanto Chemical Co., St. Louis.

MONTHLY PROGRESS LETTER NO. 12—JULY 25, 1955 TO AUGUST 25, 1955. Malcolm McEwen. Aug. 31, 1955. 9p. Contract NObs-66067.

8268 NP-5931

Monsanto Chemical Co., St. Louis.

MONTHLY PROGRESS LETTER NO. 13—AUGUST 25, 1955 TO SEPTEMBER 25, 1955. Malcolm McEwen. Sept. 30, 1955. 7p. Contract NObs-66067.

8269 NP-5932

Monsanto Chemical Co., St. Louis.

MONTHLY PROGRESS LETTER NO. 14—SEPTEMBER 25, 1955 TO OCTOBER 25, 1955. Malcolm McEwen. Oct. 31, 1955. 19p. Contract NObs-66067.

8270 NP-5933

Monsanto Chemical Co., St. Louis.

MONTHLY PROGRESS LETTER NO. 15—OCTOBER 25, 1955 TO NOVEMBER 25, 1955. Malcolm McEwen. Nov. 30, 1955. 8p. Contract NObs-66067.

8271 NP-5934

Monsanto Chemical Co., St. Louis.

MONTHLY PROGRESS LETTER NO. 16—NOVEMBER 25, 1955 TO JANUARY 1, 1956. Malcolm McEwen. Jan. 15, 1956. 9p. Contract NObs-66067.

8272 WADC-TN-56-196

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

GAMMA DOSIMETRY PROPERTIES OF LINEAR POLYETHYLENE BY INFRARED ANALYSIS. Work Period Covered: July 195[5] to April 1956. James H. Tillotson and Nora E. Srp. Apr. 19, 1956. 16p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: NUCLEAR RADIATION APPLICATIONS TO ENGINEERING MEASUREMENTS.

Changes in the molecular structure of long-chain polymers by infrared analysis gives an indication of damage to material after its exposure to nuclear radiations. The intensity changes of the 5.8 and 11.0-μ infrared absorption bands in γ irradiated Marlex 50, a high-density linear polyethylene, are analyzed and presented as a measure of relative γ dosimetry. The graphs of optical density vs γ dosage are believed to represent in a realistic manner the γ dosimetry properties of the polyethylene used in this investigation. (auth)

8273

ISOTOPE EFFECTS IN RADIATIVE THERMAL NEUTRON CAPTURE. R. M. S. Hall and N. Sutin (Univ. of Durham, England). J. Inorg. and Nuclear Chem. 2, 184-91(1956) Mar.

The products of radiative thermal neutron capture in triphenylstibine have been separated by chromatography and identified by specific activity measurements. The radioactive Sb has been found in the form of the parent compound, phenylstibine and diphenylstibine oxides, the corresponding stibonic acids, as well as elementary Sb. These products account for about 80% of the radioactive Sb. The various products contain different proportions of the Sb^{122} and Sb^{124} isotopes, and their ratios vary from 1.37 ± 0.02 in triphenylstibine to 0.88 ± 0.01 for the elementary Sb. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

8274

BORIDES OF RARE EARTH METALS. B. Post, D. Moskowitz, and F. W. Glaser (American Electro Metal Corp., Yonkers, N. Y.). J. Am. Chem. Soc. 78, 1800-2(1956) May 5.

A series of tetragonal tetraborides of Pr, Sm, Gd and Yb

isomorphous with CeB_4, ThB_4 and UB_4 were prepared and their lattice constants measured. The hexaborides of the above rare earth metals, as well as those of La and Th, were also prepared by carbon and boron reduction of their respective oxides. In addition, a group of isomorphous borides of a hitherto unreported structural type were found. The exact boron content of these compounds has not yet been determined. (auth)

8275

STUDIES IN MAGNETIC CATALYSIS. PART I. RARE EARTH ION CATALYSIS OF THE DECARBOXYLATION OF OXALOACETIC ACID. E. Gelles and J. P. Clayton (Univ. of Glasgow, Scotland). Trans. Faraday Soc. 52, 353-7(1956) Mar.

The kinetics of the rare-earth ion-catalyzed decarboxylation of oxaloacetic acid have been studied in aqueous solution. For diamagnetic ions, a linear free energy relationship exists between the logarithms of the appropriate rate coefficients and thermodynamic association constants. Paramagnetic rare earth ions catalyze the decarboxylation more strongly than would be expected on the basis of this free energy relationship. (auth)

8276

ON CAMPHORATES OF SOME RARE-EARTH ELEMENTS. Ya. Ya. Dodonov and S. B. Pirkes (Saratov State Univ.). Zhur. Obshchei Khim. 26, 379-81(1956) Feb. (In Russian)

A method is presented for the preparation of d-camphorates of La, Ce, Pr, and Nd by the reaction of their aqueous chloride solutions with sodium comphorate. It has been established that d-camphorates of the Ce group are moderately soluble in H_2O; that the solubility of rare earth elements decreases in the following order: Nd, Pr, Ce, La, and Th; that the solubility of d-camphorates of rare earth elements and Th increases with cooling and decreases with heating. Also, it was observed that d-camphorates of rare earth elements are easily hydrolized and an ethyl alcohol precipitation can be used for their separation (without hydrolysis) from aqueous solutions. (R.V.J.)

8277

ON BINARY SALTS OF LANTHANUM, CESIUM, PRASEODYMIUM AND NEODYMIUM WITH NITRATE OF TRIPHENYLBENZYLPHOSPHONIUM. G. V. Medoks (Saratov Inst. of Agriculture). Zhur. Obshechei Khim. 26, 382-4 (1956) Feb. (In Russian)

Investigations are made of binary salts of $La(NO_3)_3$, $Ce(NO_3)_3$, $Pr(NO_3)_3$, and $Nd(NO_3)_3$ with $(C_6H_5)_3(C_6H_5CH_2)P$. Experiments established a considerable difference in solubility of praseodymium and neodymium salts. (tr-auth)

8278

OBSERVATIONS ON THE RARE EARTHS. LXVII. SOME OBSERVATIONS ON THE ABSORPTION SPECTRA OF NON-AQUEOUS SOLUTIONS OF SOME ACETYLACETONE CHELATES. Therald Moeller and William F. Ulrich (Univ. of Ill., Urbana). J. Inorg. and Nuclear Chem. 2, 164-75(1956) Mar.

Measurements of the absorption spectra of solutions of acetylacetonates of certain of the tripositive rare-earth metal ions in various non-aqueous solvents yield alterations in absorption intensities and resolutions of principal bands which support the view that the natures of these bands are determined by electrical fields imposed upon the $4f$ electrons by the associated anionic-type groups. For each species studied, only certain absorption bands are affected. The effects upon these bands are dependent upon the solvent used, but bear no simple relationship to dielectric constant. The absorption spectra of such solutions are in accord with Beer's law. Cryoscopic measurements show the solutes to be monomolecular in benzene and in carbon tetrachloride. (auth)

SEPARATION PROCEDURES

8279 AERE-C/R-800

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOLVENT EXTRACTION OF Pu(VI) NITRATE FROM HNO_3 AND NH_4NO_3. T. V. Healy and A. W. Gardner. Feb. 15, 1952. Decl. June 28, 1956. 56p.

The absorption spectra of $Pu(NO_3)_4$ in dibutyl carbitol has been studied over a large range of acidity. Partition coefficients of $Pu(NO_3)_4$ has been obtained for the systems dibutyl carbitol/aqueous HNO_3 over the acidity range 0 to 9 normal and for the system dibutyl carbitol/aqueous HNO_3, NH_4NO_3 from 0 to 2N acid. The change over from the neutral dinitrate complex to the stable plutonyl trinitrate $HPuO_2(NO_3)_3$ in dibutyl carbitol has been demonstrated spectrophotometrically as well as by partition studies. This trinitratoplutonyl complex is responsible for the very marked enhancement of Pu^{4+} extraction into the organic solvent. As an example, Kp_u for the system, dibutyl carbitol and 8 molar NH_4NO_3 of 0.1 normal acidity (all dinitrate in the solvent) is 1.7 whereas on raising the acidity to 1.0 normal (all trinitrate in the solvent) Kp_u is 24. Similar studies carried out on a mixed solvent, 97% dibutyl carbitol plus 3% tributyl phosphate, showed a general decrease in the amount of the trinitrate complex at the higher acidities with an eventual production of what might be a dinitrate–TBP complex at very low acidities. While the partition of the trinitrate complex was higher than that of the neutral dinitrate (6 and 19 compared with the above figures of 1.7 and 24) the general level of partition at the lower acidities was much higher than in pure dibutyl carbitol. (auth)

8280 CF-55-1-20

Oak Ridge National Lab. Tenn.

ESTIMATE OF THE COST OF PRODUCING NITROGEN 15 BY CHEMICAL EXCHANGE: AMMONIA–AMMONIUM CARBONATE SYSTEM USING CALCIUM HYDROXIDE REFLUX. B. B. Klima and W. T. Ward. Jan. 12, 1955. 152p. Contract [W-7405-eng-26]. $0.75(OTS).

Nitrogen (N^{15}) isotope can be produced 95% pure at an estimated cost of $4,014 per pound based on a production rate of one pound per day. At an increased production rate of fifty pounds per day the cost of the nitrogen 15 isotope would be reduced to $1,079 per pound. (auth)

8281 CF-56-6-74

Oak Ridge National Lab., Tenn.

THE THEORY AND SOME APPLICATIONS OF THE HYDRAULIC RAM AS APPLIED TO COUNTERCURRENT ION EXCHANGE. S. H. Jury. June 18, 1956. 22p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

It has been shown on theoretical grounds that resin pressure in a hydraulic ram is distributed according to the equation

$$\ln \frac{\frac{4k}{D} P_{R1} + \frac{dp_L}{dZ} - \frac{g}{g_c} [\rho_R - (1-\alpha)\rho_L]}{\frac{4k}{D} P_{R2} + \frac{dp_L}{dZ} - \frac{g}{g_c} [\rho_R - (1-\alpha)\rho_L]} = \frac{4k}{D} (Z_2 - Z_1).$$

In a countercurrent ion exchange section of a column the critical fluidizing condition is $-(dp_L/dZ) = (g/g_c)[\rho_R - (1-\alpha)\rho_L]$, which agrees very well with experimental evidence. The resin pressure distribution in a countercurrent section resembles, in many respects, that of the ram section. In the ram section there is a maximum in P_{R2} as L is varied and D, Δp_L and P_{R1} are held constant. This fact has been made the basis of a graphical design procedure for a unit consisting of a ram and a

countercurrent section. A method and analytical procedure have been developed for determining the dynamic coefficient of sliding friction between resin-water and the walls of the column involved. Illustrative applications of theory to experimental data are given. (See also CF-53-1-213.) (auth)

8282 IDO-14380

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SPECTROPHOTOMETRIC DETERMINATION OF URANIUM IN HIGHLY IMPURE SOLUTIONS. Robert B. Kimball and James E. Rein. July 13, 1956. 17p. Contract AT(10-1)-205. $0.20(OTS).

A simple separations procedure and a reliable spectrophotometric procedure have been combined to form an analytical method for U that is fast, accurate, and extremely tolerant to many impurities. Approximate tolerance limits for 94 impurities are reported. (auth)

8283 NYO-7780

Aeroprojects, Inc., West Chester, Penna.

INVESTIGATIONS TO DETERMINE THE FEASIBILITY OF ULTRASONIC LIQUID-LIQUID EXTRACTION. Progress Report No. 5 Covering Period from April 1 to May 31, 1956. May 1956. 12p. Contract AT(30-1)-1798. $3.30 (ph OTS); $2.40(mf OTS).

Experiments at 270 kilocycles have established that it is possible by ultrasonic means to induce coalescence of a dispersed phase and breaking of an emulsion in a kerosene-water system even when these emulsions are stabilized with gelatin. (auth)

8284 ORNL-2084

Oak Ridge National Lab., Tenn.

THE EQUILIBRIA BETWEEN DI-n-DECYLAMINE AND SULFURIC ACID. Kenneth A. Allen. Apr. 30, 1956. 32p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Benezene solutions of di-n-decylamine have been equilibrated with aqueous H_2SO_4 at 26°C. The amine salts remain in the organic phase, and the data are interpreted on the basis of aggregation of these species. Equilibrium constants for the formation of colloidally dispersed amine sulfate and for sulfate-bisulfate exchange within the colloid are evaluated. The precipitation of pure di-n-decylamine bisulfate at a given acid activity independent of total amine concentration is attributed to a maximum bisulfate content for a stable colloidal dispersion corresponding to approximately equal moles of sulfate and bisulfate. (auth)

8285 ORNL-2111

Oak Ridge National Lab., Tenn.

DETERMINATION OF TIN IN SOLUTIONS OF URANYL SULFATE. Oscar Menis, D. L. Manning, R. G. Ball. Aug. 10, 1956. 21p. Contract W-7405-eng-26. $0.25 (OTS).

A method is described for the determination of microgram quantities of Sn in solutions of UO_2SO_4. In this method, Sn is separated from U by precipitating it as the hydroxide on an AlO(OH) carrier in a basic carbonate medium. The precipitate, which contains the Sn with the carrier, is then dissolved in HCl, following which the Sn in amounts as low as 2 μg from as much as 200 mg of U by a single precipitation. The coefficient of variation for the determination of Sn in amounts ranging from 2 to 50 μg is approximately 10%. (auth)

8286 RFP-64

Dow Chemical Co. Rocky Flats Plant, Denver.

SORPTION OF CHROMATE BY DOWEX 1. R. W. Woodard and L. Hampton. Feb. 1955. 34p. Contract AT(29-1)-1106. $0.25(OTS).

A laboratory investigation was made to explore the use of Dowex 1 for the removal of CrO_4^{2-} from neutral solution. It was found that CrO_4^{2-} is sorbed by Dowex 1 under a variety of conditions. Chromate is sorbed by Dowex 1 when the resin is in the Cl^-, NO_3^-, or free base form. The effect of temperature during the absorption cycle was not large in the range of 30°C to 85°C. Absorbed CrO_4^{2-} can be readily eluted by NaCl, NH_4NO_3, or NaOH solutions. Dowex 1 was found to be stable when put through the chromate sorption and NaOH elution cycle fifteen times. (auth)

8287 WIN-29

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

STUDIES OF THE EFFECTS OF VARIOUS TYPES OF AGITATION ON THE EXTRACTION OF URANIUM FROM A SAMPLE OF UTEX ORE. P. N. Thomas. Dec. 1, 1955. 41p. Contract AT(49-6)-924. $0.30(OTS).

Test data are presented showing the effects of various types of agitation on the extraction of U by acid leaching of U ores. (J.E.D.)

8288 AEC-tr-2528

ION-EXCHANGE RESINS USED IN ANALYTICAL CHEMISTRY. (TWELFTH REPORT). DETERMINATION OF ABSORPTION BANDS BY A HIGH-FREQUENCY METHOD. (PREVIEW). Masatake Honda. Translated from [J. Chem. Soc. Japan, Pure Chem. Sect. 73, 529(1952)]. 3p.

8289 AEC-tr-2530

STAINING OF ACID MUCO-POLYSACCHARIDES SEPARATED BY PAPER ELECTROPHORESIS WITH ALCIAN 8 G. N. C. Rizzoli and M. A. Gliozzi. Translated from Boll. soc. ital. biol. sper. 31, 426-8(1955). 7p.

All acid muco-polysaccharides separated by electrophoresis on paper are intensely reactive to alcian 8 G. N. The coloration in this case occurs parallel to metachromasis with toluidine blue in the same materials, but is not related to the periodic oxidizability. Thymonucleic acid is slightly colorable with alcian 8 G. N., although much less intensely than acid muco-polysaccharides, thus confirming a preceding histological observation of one of us. Under the experimental conditions it is also perhaps slightly chromotropic. It is concluded that alcian 8 G. N. through these investigations also appears as a colorant strongly eligible for the acid tissue mucins, an eligibility which is directly parallel to that for toluidine blue. A secondary finding of noteworthy importance which results from these investigations is the lack of periodic oxidizability of the common muco-polysaccharides in the connecting tissue. Coloration with alcian 8 G. N., adequately controlled, used with judgment, can render valuable service for the staining and individualized treatment of muco-polysaccharides migrated on paper, because it is free of many defects connected with the techniques related to toluidine blue. (auth)

8290 AEC-tr-2539

ELECTROCHEMICAL SEPARATION OF BINARY ALLOYS OF Pb WITH Bi, Sb, As AND Sn IN MOLTEN ELECTROLYTES. Iu. K. Delimarskii, P. P. Turov, and E. B. Hitman. Translated from Ukrain. Khim. Zhur. 21, 687-93(1955). 17p.

The conditions for the electrolytic separation of binary metal alloys of Pb–Bi, Pb–Sb, Pb–Sn, and Pb–As with the use of a triple eutectic of $PbCl_2$–KCl–NaCl as the fused electrolyte were studied. Anodal polarization, occurring at all of the observed anodal current densities, is practically completely dependent on changes in concentration in the salt phase. Significant polarization, arising following concentrated changes in the metallic phase, is seen only in cases of almost complete extraction of Pb from the alloy. It is established that Bi, Sb, and As collect in the anodal alloy during electrolysis; the separation of Sn from Pb is hampered. (auth)

8291 AERE-Lib/Trans-605

THE HYDROCYCLONE AS AN AUXILIARY APPARATUS FOR THE REFINEMENT OF RAW MATERIALS. H. Trawinski. Translated by F. Hudswell from Chem. Ing. Tech. 25, 331-41(1953). 28p.

The hydrocyclone has made its appearance as an apparatus equal in value to the centrifuge. The functional differences and the limits of the ranges of application are elucidated for both types of centrifugal separator. The constructional development of the hydrocyclone is shown. A dimensionless characteristic quantity for the separation is introduced in order to embrace all the empirical relations concerning the particle sizes of separation in cyclones. The functioning of a separator can be judged from the Rammler-Bennett net. Finally, a report is made on operational problems of the hydrocyclone and on the applications which have been attempted to date. (auth)

8292 AERE-Lib/Trans-725

ISOTOPE EXCHANGE OF SULPHUR ATOMS IN ACCELERATING AND VULCANISING MATERIALS IN THE PRESENCE OF DIPHENYLGUANIDINE AND PHENYL-β-NAPHTHYLAMINE. G. A. Bloch, E. A. Golubkova, and K. V. Kurskaya. Translated by S. Botcharsky from Doklady Akad. Nauk S.S.S.R. 105, 275-8(1955). 7p.

The exchange of sulfur between elemental S and mercaptobenzothiazol (Captax) at 100 and 125°C in the presence of diphenylguanidine (DPG) and phenyl-β-naphthylamine was investigated. Results indicated that DPH increased the rate of isotopic exchange while phenyl-β-naphthylamine had no effect on the exchange rate. (C.W.H.)

8293 TIB/T-4486

THE CHROMATOGRAPHIC SEMI-MICROANALYSIS OF GASES. IX. THE DETERMINATION OF NITROUS OXIDE. (Chromatografická Semimikroanalysa Plynu. IX. Stanoveni Kysliciniku Dusneho.) J. Janak and M. Rusek. Translated from Chem. Listy 48, 397-400(1954). 7p.

A method is described for the analysis of N_2O on carbon grains and silica-gel B at temperature of 20° and 80°C. The separation of N_2O in mixtures is discussed. (W.L.H.)

8294

A THERMODYNAMIC CALCULATION OF CATION EXCHANGE SELECTIVITIES. G. E. Myers and G. E. Boyd (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 60, 521-9(1956) May.

A complete and thermodynamically rigorous computation of the selectivity coefficients, D, shown by variously cross-linked sulfonated polystyrene cation exchangers in the exchange of H^+, Li^+, K^+, and Cs^+ with Na^+ was carried out using the Gibbs-Donnan equation. Exact evaluations of the osmotic free energies and of the activity coefficient ratios for the exchangers were performed using cross-differentiation relationships which are valid for ternary mixtures. A comparison of experimentally determined D values with those computed showed a general agreement within the errors involved. However, significant discrepancies were found with the more highly cross-linked exchangers. The important conclusion was drawn that cation exchangers prepared by the sulfonation of polystyrene-divinylbenzene co-polymers are chemically heterogeneous in that more than one type of ionogenic group may be present in their structure. (auth)

8295

CATION-EXCHANGE EQUILIBRIA INVOLVING SOME DIVALENT IONS. O. D. Bonner and Frances L. Livingston (Univ. of South Carolina, Columbia). J. Phys. Chem. 60, 530-2(1956) May.

Equilibrium studies involving Cu^{2+}, Ba^{2+}, Sr^{2+}, and Ca^{2+} on Dowex 50 resins of approximately 4, 8, and 16% divinylbenzene content have been made while maintaining a constant ionic strength of approximately 0.1. Selectivity coefficients have been measured at various resin loadings. The characteristic maximum water uptake of the resin in these ionic forms is reported. (auth)

8296

EXTRACTION OF INORGANIC SALTS BY 2-OCTANOL. II. COBALT(II) AND NICKEL(II) CHLORIDES AND BROMIDES. EFFECT OF ELECTROLYTES. T. E. Moore, R. W. Goodrich, E. A. Gootman, B. S. Slezak, and Paul C. Yates (Oklahoma A & M Coll., Stillwater). J. Phys. Chem. 60, 564-7(1956) May.

An analysis of the distribution coefficients of $CoCl_2$ and $NiCl_2$ between 2-octanol and aqueous mixtures with HCl at constant concentration has been made by studying the variations in the non-aqueous and aqueous phase activity coefficients with salt concentration. In approximately 5 molal acid the octanol-rich phase activity coefficient for $CoCl_2$ remains nearly constant while that for $NiCl_2$ increases rapidly, thus accounting for the difference in the extractability of the two salts and also their separation by 2-octanol extraction. Study of the effect of different valence-type chlorides upon the distribution coefficient of $CoCl_2$ showed a marked dependence upon the specific extraction-promoting chloride present. The order of promoting effectiveness is HCl > LiCl > $CaCl_2$ > $AlCl_3$ or $(CH_3)_4NCl$. This parallels the order of extraction of the promoting electrolytes themselves. As predicted by the Born equation for ion charging, the distribution coefficients of $CoBr_2$ are greater than those of $CoCl_2$ at the same concentrations because of the larger anion. The extraction of $CoBr_2$ from aqueous mixtures with LiBr, $CaBr_2$, and $AlBr_3$ does not depend greatly upon the valence-type of the promoting salt at equivalent concentrations (in contrast with the case of $CoCl_2$). An explanation for the separation of $CoCl_2$ from $NiCl_2$ by 2-octanol extraction is suggested. (auth)

8297

EXTRACTION FROM SLURRIES BY ION-EXCHANGE RESINS. E. A. Swinton and D. E. Weiss (C.S.I.R.O., Melbourne, Australia). Australian J. Appl. Sci. 7, 98-112(1956) Mar.

A pulsating technique is described which extends the use of the conventional ion-exchange procedure to the direct adsorption of soluble constituents from suspensions of finely divided solids, without the necessity for prior filtration. Slurries containing up to 40% by weight of solids have been passed through a bed of ion-exchange resin by pulsating the flow. It has been established that the process of displacement and ion exchange is as efficient as in conventional procedures using the same resin. An application of the process to the extraction of uranium ores is briefly described. (auth)

8298

THE RATE OF SWELLING OF ION-EXCHANGE RESIN PARTICLES IN DIFFERENT SALT SOLUTIONS. Carlos Pulido (Univ. of Uppsala, Sweden). Acta Chem. Scand. 10, No. 1, 49-55(1956).

8299

ON THE CHEMICAL STATE OF ^{32}P AND ^{33}P IN A SULPHUR TARGET. Gösta Nilsson (Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 10, No. 1, 94-105 (1956).

The yields of P^{32}, P^{33} and S^{35} by the irradiation of sulfur in the Norwegian D_2O-reactor at Kjeller have been determined for different sample positions in the reactors. It was found that a large amount of P^{32} and P^{33} but hardly any S^{35} followed the insoluble S_μ-fraction of the sulfur samples on dissolving in CS_2. Adsorption can be responsible for this phenomenon but an alternative explanation, assuming S_μ formation in "displacement spikes", is also given. The initial S_μ content of the sublimated sulfur samples decreased on reactor irradiation. No significant chemical difference

was found between P^{32} and P^{33} after extraction from a solution of irradiated sulfur in CS_2 to a water phase. The separation factor for a process where two atoms with recoil ranges r_1 and r_2 recoil from a spherical particle into a catcher phase surrounding the particle has been calculated and applied to the case of P^{32} and P^{33} recoiling from colloidal sulfur particles. (auth)

8300

STUDIES ON THE EXTRACTION OF METAL COMPLEXES. XXII. THE COMPLEX FORMATION OF THORIUM WITH 1-NITROSO-2-NAPHTHOL AND 2-NITROSO-1-NAPHTHOL. David Dyrssen, Margareta Dyrssen, and Ebbe Johansson (Research Inst. of National Defence, Sundbybery, Sweden and Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 10, No. 1, 106-12(1956).

The extraction of Th with chloroform or hexone using 1-nitroso-2-naphthol and 2-nitroso-1-naphthol as complexing agents has been studied at 25°C. The perchlorate ion concentration in the aqueous phase was kept constant at 0.1 M. The mean complexity constants are found to be $10^{8.50}$ for 1-nitroso-2-naphthol and $10^{8.30}$ for 2-nitroso-1-naphthol. These values are lower than for oxine, but higher than for acetylacetone. (auth)

8301

AN ION-SIEVE REAGENT FOR CAESIUM–ALKALI-METAL SEPARATIONS. R. M. Barrer and D. C. Sammon (Univ. of Aberdeen). J. Chem. Soc., 675-82(1956) Mar.

The use of silver analcite as an ion-sieve reagent for separations of Na, K, and Rb from Cs has been investigated. The removal of Na and K from mixtures with Cs (all as chlorides) occurred quantitatively, and readily at about 100°, according to the equation $MCl + xAgA(s) \rightarrow AgCl(s) + MAg_{(x-1)}A_x(s)$ where A denotes the anionic framework of analcite and M is Na or K. In the removal of Na, no Cs entered the silver analcite and the method is suitable for quantitative analysis. In the K–Cs separation a phase change occurs involving a minor rearrangement of the silver analcite to the potassium analcite (leucite) structure, and a little Cs may be incorporated during this process. The Rb–Cs separation is more difficult and requires the use of methanol (or ethanol) as solvent; again a little Cs may be incorporated during the phase change owing to modification of the silver analcite framework to the rubidium analcite one. Hydrogen-ion exchange was observed when solutions of caesium chloride, tetramethylammonium bromide, or tetraethylammonium iodide were treated with silver analcite: $H_2O + MX + xAgA(s) \rightarrow AgX(s) + HAg_{(x-1)}A_x(s) + MOH$. By using the iodide this exchange was followed up to 60% completion. It can only proceed when the crystal acts as a sieve or semipermeable membrane towards the cations in solution and when the ion displaced is precipitated as an insoluble compound. (auth)

8302

ADSORPTION STUDIES ON CLAY MINERALS. VI. ALKALI IONS ON ATTAPULGITE. C. Neale Merriam, Jr., and Henry C. Thomas (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 24, 993-5(1956) May.

The exchange equilibria of the alkali ions Cs, K, Na, and Li on attapulgite have been studied at 30 and 75°C. Thermodynamic data for the systems have been calculated. Cesium is the most strongly adsorbed ion and the others follow in the order given. The specificity of the clay becomes lower at the higher temperature. (auth)

8303

EFFECTS OF A CONCENTRATION DEPENDENCE OF THE SEDIMENTATION COEFFICIENT IN VELOCITY ULTRACENTRIFUGATION. Hiroshi Fujita (Univ. of Wisconsin, Madison). J. Chem. Phys. 24, 1084-90(1956) May.

The Lamm differential equation for the sedimentation process in the ultracentrifuge is solved in closed form for the case in which the sedimentation coefficient, s, decreases linearly with the concentration, C, by employing the assumption which was adopted originally by Faxen who considered a similar problem with s independent of C. It is shown that, with increasing concentration dependence of s, the concentration gradient curve is markedly sharpened, and the whole curve is also noticeably shifted towards the solvent side, but symmetry of the curve is practically maintained except at the edges. A simple and approximate equation which predicts the position of the maximum of a given boundary curve as a function of time for a given set of the parameters is derived. It is shown that this equation is useful for evaluating the sedimentation coefficient at a given concentration. An equation which also predicts the maximum height of the boundary curve as functions of time and related parameters with a satisfactory degree of approximation is obtained. Using this equation, reliable values of the diffusion coefficient may be obtained from sedimentation experiments when s depends linearly on C. (auth)

8304

FAST SEPARATIONS OF CATIONS USING ASCENDING PAPER CHROMATOGRAPHY. George W. Warren and Richard W. Fink (Univ. of Arkansas, Fayetteville). J. Inorg. and Nuclear Chem. 2, 176-9(1956) Mar.

Separations of microgram quantities of radioactive Hg, Tl, Bi, and Pb; and of non-radioactive Pt, Au, Cu, Ni, Co, Fe, Cd, Ag, and Pd, in from 2 to 20 min, have been achieved using a new method of ascending paper chromatography with acetone containing various complexing agents as the developer. The new technique involves the use of thick absorbent paper having high wettability, a developer of high wetting power, and, in particular, an atmosphere which is supersaturated with vapours of the solvent. (auth)

8305

NUCLEAR RECOIL AS MEANS OF FISSION PRODUCT SEPARATION. Richard Wolfgang (Brookhaven National Lab., Upton, N. Y.). J. Inorg. and Nuclear Chem. 2, 180-3 (1956) Mar.

It has been demonstrated that, by use of a suitable heterogeneous system, the nuclear recoil of fission products can be used to effect their complete separation from the parent fissile material. The potentialities of this simple technique are briefly discussed. (auth)

8306

LIQUID-LIQUID EXTRACTION PROCEDURES IN INORGANIC ANALYSIS. A REVIEW OF PRACTICAL APPLICATIONS WITH PARTICULAR REFERENCE TO METALLURGICAL ANALYSIS. T. S. West (Univ. of Birmingham, England). Metallurgia 53, 185-8(1956) Apr.

Liquid-liquid solvent extraction techniques for Al, Ga, In, Tl and the rare earths are surveyed in this part of a series of articles on extraction techniques in inorganic analysis with particular reference to metallurgical analysis. See Metallurgia 53, 134(1956) Mar.

8307

SOLVENT EXTRACTION OF POLONIUM FROM NITRIC ACID SOLUTIONS. J. Danon and A. A. L. Zamith (Escola Nacional de Quimica, Rio de Janeiro). Nature 177, 746-7 (1956) Apr. 21.

The solvent extraction of trace Po in HNO_3 solutions by organic solvents was investigated. Peroxide-containing ether extracts ~65% of Po present from 8M HNO_3 solutions; peroxide-free ether extracts Po from HNO_3 solutions containing reducing agents. (C.W.H.)

8308

DIRECT RADIOMETRIC MEASUREMENT BY GAMMA-RAY SCINTILLATION SPECTROMETER. PART I. URANIUM AND THORIUM SERIES IN EQUILIBRIUM. Patrick

M. Hurley. Bull. Geol. Soc. Amer. 67, 395-404(1956) Apr.

Where uranium and thorium are in secular equilibrium with their decay products, these elements may be determined by this direct radiometric method if the materials show more than 0.01% equivalent uranium. This method is based on the measurement in a scintillation spectrometer of the relative amplitude of the response from the 238 kev gamma ray from Pb^{212}. Tests on known samples containing different relative proportions of uranium and thorium have verified the predicted precision of better than 4% standard deviation per single comparison with a standard when the element measured is a major contributor to the activity. (auth)

8309

THEORY OF ION EXCHANGE DYNAMICS. DYNAMICS AND KINETICS OF ION EXCHANGE FOR THE CASE OF LINEAR ISOTHERM. V. V. Rachinskiĭ, and O. M. Todes (Timiryazev Agricultural Academy). Zhur. Fiz. Khim 30, 407-16(1956) Feb. (In Russian)

An asymptotic solution has been obtained for the differential equation of ion exchange. The theory has been proved experimentally with the aid of the isotope method. It has been confirmed that the center of the sorption wave front moves with constant speed and that the front spreads out proportionally to $\sqrt{t}$. The values were checked on the rate constant of ionic sorption of labeled ions of Na and Rb on the swelling resin. The constants are of the order 1 sec^{-1}. (tr-auth)

Refer also to abstracts 8220, 8222, and 8534.

SORPTION PHENOMENA

8310 NP-5930

Lehigh Univ., Bethlehem, Penna. Surface Chemistry Lab.
HETEROGENEITY OF SURFACES. IMMERSIONAL CALORIMETRY AND ADSORPTION STUDIES OF THE HETEROGENEOUS NATURE OF THE SURFACES OF METALLIC AND NON-METALLIC SOLIDS. Final Report [Covering Period] January 1, 1949 to December 31, 1955. 54p. Project No. NOR-358-186. Contract N8onr-74300.

The rates of oxidation of Co and Ni powders were measured in the thin film region at −78, −22, 0, and 26°C. During the first oxidation of a reduced sample at each temperature, multiple oxide layers formed to some limiting thickness. This surface could be regenerated for further oxidation by heating in vacuo. Successive oxidations of the metallic sample were thus carried out, initially on the reduced sample, thereafter on the regenerated surface. The amount of oxygen adsorbed by the reduced and regenerated samples was an exponential function of time. The theory of Mott and Cabrera for the growth of very thin oxide films did not satisfactorily explain the results. The governing kinetic factor for both Ni and Co was found to be the increase in oxide thickness rather than the total oxide film thickness. A mechanism based on the formation of metal lattice vacancies and their elimination by heating is proposed. Nitrogen, NH_3, and water vapor adsorption isotherms were measured on a Wyoming bentonite, a montmorillonite. In the BET range, N_2 and H_2O measured only the external area, whereas NH_3 measured the internal area as well. The adsorption isotherms were monotonous and uninstructive, but heats of immersion in water of samples equilibrated at increasing water vapor pressures reflected the regions at which the first and second layers of water formed between the platelets. X-ray data for the x-axis spacing confirmed these findings. Comparison of the heat of immersion curves for samples activated at 25 versus 100°, and with the adsorption isotherms, revealed high-energy sites for H_2O adsorption. These are apparently exchange ion sites. (auth)

8311 AEC-tr-2516

THE MECHANISM OF CHEMISORPTION ACCORDING TO THE DISORDER THEORY. K. Hauffe and H. J. Engell. Translated from Z. Elektrochem. 56, 366-73(1952). 19p.

Data are presented for the adsorption of O_2 on semiconducting oxides. The effects of the surface layer formation on conductivity are discussed. (W.L.H.)

8312

ON THE SELECTIVE ACTIONS OF CATALYZERS PREPARED FROM NICKEL OXIDES, TREATED BY WATER – STEAM PRESSURE. L. Kh. Freĭdlin, A. A. Balandin, and N. V. Borunova. (Zelinskiĭ Inst. of Organic Chemistry). Izvest. Akad Nauk S.S.S.R. Otdel. Khim. Nauk. 128-30(1956) Jan. (In Russian)

It has been established that nickel and aluminum oxides strongly recrystallize under water – steam pressure treatment. The experiments treated nickel oxides on a carrier to various conditions of aging by water – steam pressures, which resulted in producing a selective catalysis of controlled activity. It lost its hydration activity for the aromatic bonds but retained it for C = C and C = O bond hydration reactions. (R.V.J.)

SYNTHESES

8313 NP-5918

Standard Oil Co. of Indiana, Whiting.
DEVELOPMENT AND EVALUATION OF HIGH TEMPERATURE GREASES. Quarterly Progress Report No. 17 [for] period April 10, 1955 to July 10, 1955. Edward A. Swaken and Delmar D. Krehbiel. July 1955. 22p. Contract AF33(038)23687.

Monthly Progress Report No. 50 is incorporated in this report and will not be submitted separately.

Progress is reported in the development and evaluation of wide-temperature-range greases suitable for use from −65°F to 450°F and above. Twelve arylurea derivatives of ortho-tolidene and other high-melting compounds were screened as possible thickeners. Bearing performance test data are presented. Data are appended on properties of the compounds tested. (C.H.)

8314 AEC-tr-2537

SYNTHESIS OF PHYSIOLOGICALLY ACTIVE S^{35}-LABELED COMPOUNDS. Yu. V. Markova, A. M. Pozharskaya, V. I. Maimind, T. F. Zhukova, N. A. Kosolapova, and M. N. Shchukina. Translated from Doklady Akad. Nauk U.S.S.R., 91, 1129-32(1953). 7p.

Methods were studied for microsynthesis of S^{35}-labeled compounds of various types, starting with $BaSO_4$ in which form the radioactive isotope of S is generally available. (auth)

8315

OXAZOLE QUATERNARY SALTS. Donald G. Ott, F. Newton Hayes, and Vernon N. Kerr (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 78, 1941-4(1956) May 5.

2,5-Disubstituted-3-methyloxazolium salts have been prepared for pharmacological investigations of their notable inhibition of thermoregulation in animals. General procedures are described for the anions tosylate, perchlorate, iodide, and chloride. Hydrolytic studies on the oxazolium ring ion have been carried out. Ultraviolet absorption maxima and representative infrared absorption data are given. (auth)

8316

TRANSFER OF OXYGEN IN THE GLUTAMINE SYNTHETASE REACTION. Arthur Kowalsky, C. Wyttenbach, L. Langer, and D. E. Koshland, Jr. (Brookhaven National Lab., Upton, N. Y.). J. Biol. Chem. 219, 719-25(1956) Apr.

8317
POLYMER SYNTHESIS BY GAMMA RADIATION. T. D. Callinan (Naval Research Lab., Washington). J. Electrochem. Soc. 103, 292-6(1956) May.

Monomers have been polymerized successfully by the action of gamma rays to high molecular weight solids without the employment of elevated temperatures or catalysts. Among the monomers polymerized were ethylene, styrene, methylstyrene, acrylonitrile, and methyl methacrylate. Low molecular weight polyester syrups have been solidified into hard transparent solids without the use of the usual catalysts and accelerators. Some chemical and physical properties of these polymers have been determined. Observed values are compared with the properties of polymers obtained by thermal and catalytic activation. Radiation energies required for causing polymerization have been determined. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

8318 AERE-GP/R-1906
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
PLUTONIUM: EVAPORATION TESTS, IONISATION POTENTIAL AND ELECTRON EMISSION. Ralph H. V. M. Dawton and Kenneth L. Wilkinson. Apr. 1955. 14p.

Tests were made on the evaporation of Pu from crucibles of different materials in order to find the fraction which can be evaporated. The best crucible materials were found to be W or Ta. Graphite, either alone or coated internally with Al_2O_3 or BeO was unsatisfactory. By estimating the rate of effusion from the crucible the vapor pressure of Pu was found to be 10^{-3} mm of Hg at 1450 ± 50°C. 7% of the Pu atoms which struck a W surface at 2600°C were ionized when the incident flux of neutrals was in the region of 10^{15} to 10^{16} atoms/cm^2/sec. Under the same conditions a measurement of the saturated electron and ion emission gave a value of 5.1 ± 0.5 electron volts for the ionization potential of Pu. Tungsten and Ta surfaces coated with Pu gave electron emissions comparable with that from thoriated W. (auth)

8319 AERE-Lib/Trans-645
ISOTOPE SHIFTS IN THE PLUTONIUM SPECTRUM. A. R. Striganov, L. A. Korostyleva, and Yu. P. Dontsov. Translated by J. B. Sykes from Zhur. Eksptl'. i Teoret. Fiz. 28, 480-4(1955). 5p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-4977.

8320
THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART III. X-RAY DIFFRACTION STUDIES OF PLUTONIUM HYDRIDE. B. J. McDonald and J. B. Fardon (U. K. Atomic Energy Authority, Windscale, Cumb., England). J. Chem. Soc., 781-2(1956) Mar.

8321
THE ALPHA HALF-LIFE OF Am^{241}. G. R. Hall and T. L. Markin (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 2, 202-3 (1956) Mar.

A mean value of 461.3 ± 1.7 yr was obtained for the α half life of Am^{241}. The corresponding value for the half life of Pu^{241} is 13.25 yr. (C.W.H.)

8322
RELATIVE YIELDS OF CALIFORNIUM ISOTOPES PRODUCED BY BOMBARDMENT OF URANIUM WITH CARBON-12 AND CARBON-13 IONS. J. H. Fremlin (Univ. of Birmingham, England) and Kathleen M. Glover and J. Milsted (Atomic Energy Research Establishment, Harwell Berks, England). J. Inorg. and Nuclear Chem. 2, 263-4(1956) Apr.

Californium isotopes Cf^{248} were formed in larger yields when C^{13} was used as the bombarding particle on U rather than C^{12}. (C.W.H.)

8323
MAGNETIC SUSCEPTIBILITY OF PLUTONIUM HEXAFLUORIDE. D. M. Gruen, J. G. Malm, and B. Weinstock (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 24, 905-6(1956) Apr.

Values of 131 × 10^{-6} at 81°K and 173 × 10^{-6} at 295°K were determined for the magnetic susceptibilities of polycrystalline PuF_6 using the Faraday method. (C.W.H.)

8324
FLUORESCENCE SPECTRUM OF Am^{3+} IN $LaCl_3$. D. M. Gruen (Argonne National Lab., Lemont, Ill.) and John G. Conway, R. D. McLaughlin, and B. B. Cunningham (Univ. of California, Berkeley). J. Chem. Phys. 24, 1115-16(1956) May.

8325
KINETICS OF THE REACTION BETWEEN NEPTUNIUM(IV) AND NEPTUNIUM(VI) IN A MIXED SOLVENT. Donald Cohen, E. S. Amis, J. C. Sullivan, and J. C. Hindman (Argonne National Lab., Lemont, Ill.). J. Phys. Chem. 60, 701-2(1956) May 5.

The reaction between Np^{4+} and Np^{6+} was carried out in ethylene glycol-aqueous $HClO_4$ solvent at 25°C. In 12.1M ethylene glycol, the reaction rate was found to be 0.158 ± 0.009 $(mol/l)^{5/3}$/sec. The variation of the reaction rate with glycol concentration indicated the presence of glycol in the activated complex. (C.W.H.)

Refer also to abstracts 8626 and 8717.

URANIUM AND URANIUM COMPOUNDS

8326 BMI-1108
Battelle Memorial Inst., Columbus, Ohio.
THE REACTION OF HYDROGEN WITH URANIUM ALLOY TYPES. William M. Albrecht and Manley W. Mallett. July 11, 1956. 18p. Contract W-7405-eng-92. $0.20 (OTS).

The reactions of H_2 with various U alloys were investigated in the range 100 to 425°C. A gamma-stabilized alloy (uranium-12 wt.% molybdenum) did not pick up H_2 at 1-atm pressure. The behavior of H_2 with two-phased alloys, U-5 wt.% Zr and U-5 wt.% Cr, was similar to that for H_2 with pure U. However, the reaction rates were only about one-half as fast. Solubilities of hydrogen in the alloys also were determined. (auth)

8327 BMI-1110
Battelle Memorial Inst., Columbus, Ohio.
THERMAL DECOMPOSITION OF URANYL NITRATE HEXAHYDRATE. J. Robert Bridge, Carl W. Melton, Charles M. Schwartz, and Dale A. Vaughan. July 12, 1956. 20p. Contract W-7405-eng-92. $0.25(OTS).

The pyrolytic decomposition of uranyl nitrate hexahydrate in the absence of the decomposition gases has been investigated at low and atmospheric pressures. X-ray diffraction and chemical analyses were made of the decomposition products at several temperatures from 25° to 250°C. At temperatures below 190°C, the amount of water evolved from uranyl nitrate hexahydrate is pressure dependent. The nitrate approaches the anhydrous state on heating to 190°C at either low or atmospheric pressure. Nitrogen evolution occurs mainly above 190°C. X-ray diffraction examination of partially decomposed $UO_3(NO_3)_2 \cdot 6H_2O$ revealed nitrate phases not previously reported; these appear to be nearly anhydrous. Amorphous UO_3 is formed as an end product when the decomposition gases are removed from the vessel and not permitted to remain in contact with the decomposition product. If, however, the gases (in particular water vapor) are allowed

to react with the decomposition product, Mallinckrodt-type UO_3 is produced. Diffraction data for four nitrates and two types of UO_3, prepared in the course of the decomposition studies, are given. (auth)

8328 CEA-363

France. Commissariat à L'Énergie Atomique, Paris.

CONTRIBUTION A L'ETUDE CRISTALLOGRAPHIQUE DU SYSTEME URANIUM–OXYGENE (theses). (Contribution to the Crystallographic Study of the Oxygen–Uranium System (thesis). Pierre Perio. 1955. 111p.

A detailed study was made of the properties of the crystallographic species between U and UO_3. Remarks concerning the low-temperature oxidation kinetics of UO_2 are also included. (B.J.H.)

8329 DP-165

Du Pont De Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

DETERMINATION OF TRACES OF THORIUM IN URANIUM SOLUTIONS. Myron O. Fulda. June 1956. 10p. Contract AT(07-2)-1. $0.15(OTS).

A colorimetric method was developed for the determination of 1 to 100 ppm of Th in U solutions. The indicator was thorin and the standard deviation was 7 per cent at 1 ppm and 2 per cent at 100 ppm. (auth)

8330 IGO-R/S-17

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF IRON IN URANIUM–MOLYBDENUM AND NIOBIUM–MOLYBDENUM ALLOYS. R. Dickinson and J. R. Sanderson. Jan. 1956. 24p. (IGC-ARDC/P-177).

The special conditions required for the determination of iron as its 1-10 phenanthroline complex in the presence of the major alloying elements have been established. Full color formation in the presence of tartrate–required to counter-complex U and Nb–is sensitive to temperature; when a high pH is necessary to prevent precipitation of a major constituent, the temperature must be correspondingly increased. Investigation of interference by cations and anions has been limited to those expected in the source from which samples will be taken. (auth)

8331 NAA-SR-1598

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE DIFFUSION OF HELIUM IN THORIUM AND URANIUM. Alan Andrew, Clifton R. Davidson, and Lyle E. Glasgow. July 15, 1956. 18p. Contract AT-11-1-GEN-8. $3.30(ph OTS); $2.40(mf OTS).

Thorium and U foils were impregnated with α particles from the 60-inch Berkeley cyclotron. Subsequent heating showed that under 1040°C no He diffuses out of U. Helium was observed to diffuse out of Th following Fick's Law with the following constants: E (activation energy) = 38 kcal/mol, and D_0 (diffusion constant) = 10^{-4} to 10^{-3} cm^2/sec. (auth)

8332 NP-6047

Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies.

MAGNETIC SUSCEPTIBILITIES OF URANIUM(V) AND URANIUM(III) CHLORIDES. Paul Handler and Clyde A. Hutchison, Jr. [1956]. 20p. Contract N6ori-02027.

The magnetic susceptibilities of UCl_5, UCl_3, and solutions of UCl_3 in $LaCl_3$ have been measured in the temperature range from 14 to 300°K. The results are presented graphically and their general form is discussed. The susceptibility of UCl_3 apparently undergoes an antiferromagnetic transition just above the boiling point of H_2. As UCl_3 is diluted with $LaCl_3$, the behavior of the magnetic susceptibility approaches closely that of $Nd(C_2H_5SO_4)_3 \cdot 9H_2O$. The magnetic behavior of UCl_3 is consistent with that expected for an ion with three unpaired f electrons. (auth)

8333

ALKALINE IODINE AS AN OXIDANT FOR URANIUM. IV. G. S. Deshmukh and M. K. Joshi (Banaras Hindu Univ., India). Bull. Chem. Soc. Japan 28, 449-50(1955) Sept.

A new method for the determination of U based on the reduction of U^{6+} to U^{4+} and reoxidation of U^{4+} by alkaline I_2 is described. The excess I_2 is titrated with standard $Na_2S_2O_3$ or As_2O_3 and the results are found to be accurate and reproducible. (auth)

8334

POTENTIOMETRIC DETERMINATION OF U IN INERT ATMOSPHERES WITH FERRIC SULFATE. R. Fernández Cellini and J. Alonso López. Anales real soc. espan. fis. y quim. (Madrid) Ser. B 52, 163-8(1956) Mar. (In Spanish)

The potentiometric titration of U with $Fe_2(SO_4)_3$ using Cd as reducing agent has been studied. Good results were obtained with uranite minerals following phosphate removal by ion exchange. (auth)

8335

π-CYCLOPENTADIENYL COMPOUNDS OF URANIUM-IV AND THORIUM-IV. L. T. Reynolds and G. Wilkinson (Harvard Univ., Cambridge, Mass.). J. Inorg. and Nuclear Chem. 2, 246-53(1956) Apr.

Uranium tetrachloride is allowed to react with sodium cyclopentadienide in tetrahydrofuran solution. On heating the dried product at 245° in vacuum, dark-red crystals of $(\pi\text{-}C_5H_5)_3UCl$ are obtained. Some chemical and physical properties of the compound are described. A molecular orbital view of the metal-to-ring bonding is given. Evidence for the existence of π-cyclopentadienyl derivatives of Th is presented. (auth)

8336

THE SOLUBILITY OF URANIUM(IV) ORTHOPHOSPHATES IN PERCHLORIC ACID SOLUTIONS. James M. Schreyer and L. R. Phillips (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 60, 588-91(1956) May.

Solubility measurements in the $U(HPO_4)_2$–Cl_2O_7–H_2O system have been made at 25 ± 0.1° in 1.0 to 11.86M $HClO_4$. The equilibrium solid phases and their regions of stability have been demonstrated by means of the wet residue method. (auth)

Refer also to abstract 8216.

WASTE DISPOSAL

8337 IDO-14378

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MONITORING THE LIQUID WASTES DISCHARGED FROM THE IDAHO CHEMICAL PROCESSING PLANT. William C. King. June 12, 1956. 29p. Contract AT(10-1)-205. $0.25(OTS).

A continuous liquid waste monitor which has been in operation for 24 months at the Idaho Chemical Processing Plant is described. By detecting the γ activity, the monitoring system provides a method of measuring the activity in large volumes of liquid wastes which are discharged from the ICPP. The monitoring system, as described, provides a permanent record of the flow-rate and instantaneous concentration of gamma activity in the discharged waste independent of background activity. It will integrate the product of the flow-rate and count-rate to give the total activity discharged over any given period of time. The monitor activates alarms if the concentration of activity in the discharge stream becomes too great. It also collects a continuous proportional sample of the discharged liquids which can be submitted for radiochemical analyses. (auth)

8338 ORNL-301(Rev.)
Oak Ridge National Lab., Tenn.
SEPARATION OF FISSION PRODUCTS FROM ALUMINUM WASTE SOLUTIONS BY ION EXCHANGE. Period covered: September 1947–September 1948. R. E. Blanco, I. R. Higgins, and A. H. Kibbey. Aug. 14, 1956. 52p. Contract W-7405-eng-26. $0.40(OTS).

A process utilizing a scavenging precipitation and ion exchange has been developed for the separation of fission products from Al waste solutions. The behavior of individual fission products in the Al-resin system was studied. Gross β and γ decontamination factors of 10^3 with an Al yield of 97 to 99% are obtained. Decontamination factors for Cs and Sr were 10^3 to 10^4, respectively. (auth)

8339 ORNL-1984
Oak Ridge National Lab., Tenn.
DIBAN—ION EXCHANGE WASTE DISPOSAL SCHEME. [PART] I. I. R. Higgins and R. G. Wymer. Nov. 28, 1955. 20p. Contract W-7405-eng-26. $0.20(OTS).

A scheme is proposed for decontaminating radioactive wastes whose chief ingredients are $Al(NO_3)_3$ and HNO_3. Ninety percent of the Nb and more than 95% of the Ru and Zr are removed by a $Fe(OH)_3$–MnO_2 scavenging precipitation. The $Al(NO_3)_3$ is converted to $Al(OH)_2NO_3$ by destructive distillation, and dissolved by a 12-hr digestion at 160°C. The Sr, Cs, and rare earths are removed by cation exchange in a continuous contactor. The decontaminated waste can be volume-reduced to about 6 M Al before disposal and then stored cheaply. The fission products can be eluted from the column, concentrated into a small volume of highly radioactive waste, and stored with all necessary precautions. (auth)

8340 WASH-408
Division of Reactor Development, AEC.
DISPOSAL OF RADIOACTIVE WASTES IN THE U.S. ATOMIC ENERGY PROGRAM. Abel Wolman, A. E. Gorman, and J. A. Lieberman. May 17, 1956. 15p. $0.20(OTS).

The AEC program for the handling and disposal of wastes from the nuclear energy industry is outlined. Recent research and development projects for disposal of high-level wastes are listed. (C.W.H.)

ENGINEERING

8341 WADC-TR-53-322
Illinois. Univ., Urbana.
ANALYTICAL STUDIES OF THERMAL STRESSES IN MEDIA POSSESSING TEMPERATURE-DEPENDENT VISOELASTIC PROPERTIES. Harry H. Hilton, Hassan A. Hassan, and Hal G. Russell. Sept. 1953. 89p. Contract AF33(616)-291. (AD-27590)

The problem of thermal stresses in thick-walled and thin-walled cylinders and circular plates is analyzed for bodies with temperature-dependent viscoelastic properties of the Kelvin, Maxwell, and Standard Linear Solid Type. A numerical example is computed for the Kelvin body thick-walled cylinder which shows that the elastic solution and temperature independent Kelvin body solution are extremely conservative. Alfrey's elastic-viscoelastic analogy is extended to cover viscoelastic thermal stress problems with temperature-dependent material properties. (auth)

8342 WADC-TR-54-464(Pt. 2)
Denver. Univ. Denver Research Inst.
DEVELOPMENT OF SCHEMATIC ANALYTICAL PROCEDURES FOR SYNTHETIC LUBRICANTS AND THEIR ADDITIVES. [Period covered] October 1954 to September 1955. Josef J. E. Schmidt, Francis S. Bonomo, and John R. Hobaugh. June 1956. 130p. Project title: AVIATION LUBRICANTS. Task title: LUBRICANTS. Contract AF33(616)-2201.

General properties and methods for the identification and determination of components of synthetic lubricants and base-oils and their additives are presented and discussed. Included in these compounds are dibasic acid esters, silicate esters, and silicone oils, and such additives as antioxidants. Analytical procedures employing column and paper partition chromatographic techniques are presented for the identification and separation of different groups of components, such as dibasic acid esters from silicate esters and silicone oils as well as different dibasic esters from each other, along with methods for the paper chromatographic identification and separation of antioxidants in synthetic lubricants. (auth)

HEAT TRANSFER AND FLUID FLOW

8343 WADC-TR-55-348(Vol. 1)
Johns Hopkins Univ., Baltimore.
THREE-DIMENSIONAL FLOW IN AXIAL-FLOW TURBOMACHINERY. Leroy H. Smith, Jr. Aug. 1955. 140p. Project title: GAS TURBINE TECHNOLOGY. Task title: COMPRESSOR BLADING SYSTEMS OF HIGH DEFLECTION ANGLE. Contract AF33(616)-152. (AD-88126)

A method is presented by which one can include the principal effects of seconadry flow in the design of multistage axial-flow turbomachinery. The method uses the conventional axial symmetry solution as a basic flow picture from which the induced turning and radial velocities characteristic to the secondary flow can be deduced. Frictional effects, such as the growth of boundary layers on the blades, are excluded from the analysis but the disposition of the fluid which comes from boundary layers on the hub and casing surfaces upstream of a blade row can be accounted for by assuming that the fluid is frictionless while in the blading. To get a first-order approximation of the secondary flow in a blade row, it is only necessary to know the number of blades in the row and the axisymmetric flow solution. The principal assumption involved in this approximation is that the distortion of the flow surfaces due to the secondary velocities is small. The consequences of a higher approximation are discussed, but without elaboration, since it appears that the difficulties involved are great enough to make such a step undesirable in a practical sense. (auth)

8344 WAPD-TH-180
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh]. AVERAGE AND LOCAL HEAT TRANSFER COEFFICIENTS FOR PARALLEL FLOW THROUGH A ROD BUNDLE. J. R. Parrette and R. E. Grimble. [Mar. 13, 1956]. 36p. $6.30(ph OTS); $3.00(mf OTS).

Because of current interest in heat exchanger designs involving flow parallel to the axes of tubes or rods, an experimental program was conducted at Bettis to determine local and average surface heat transfer coefficients for such tubes or rods. Square array rod bundles having dimensionless pitch (ratio of center spacing to diameter) of 1.20 and 1.14 were studied using a large-scale air flow model. Average coefficients were determined by a transient technique; that is, by following the thermal history of a pre-heated specimen. Local variations from the average were determined by measuring the variation in the rates of sublimation from cast naphthalene specimens, using the mass transfer-heat transfer analogy. For the nominal arrangement, no significant peripheral varia-

tions in local heat transfer coefficient were observed with either dimensionless pitch. However, significant changes in local coefficient were observed when deviations from the nominal arrangement of geometry B were studied. (auth)

8345 WIAP-M-31

[Westinghouse Electric Corp. Industrial Atomic Power Group, Pittsburgh].

BENZENE TURBINE CYCLES. Nicholas A. Beldecos. June 1955. 55p. $0.40(OTS).

Thesis submitted to the Univ. of Pennsylvania School of Mechanical Engineering.

The subject investigation has indicated that benzene vapor in a direct comparison with steam is not as desirable a working medium. There is reason for its adoption in power plants utilizing liquid metal (alkali metals and alloys) heat exchangers and reheaters, but the desirability of this application is offset by the high flammability of benzene vapor. The cycle efficiency is enhanced considerably by regeneration and desuperheating. The effect of cycle parameters such as pressure drops, heater terminal difference, drain coolers, etc. must be considered seriously since their proportionate effect is greater with benzene than with steam. As a result of low isentropic enthalpy drop, higher mass flows are experienced resulting in pumping power requirements which may approach 20% of the gross turbine output. At the lower pressures and temperatures, cycle efficiencies comparable to those experienced with steam cycles may be attained. The design of the benzene vapor turbine introduces no serious limitations with one notable exception, that being the gland seals. (auth)

8346 AEC-tr-2525

ON THE STATIONARY FLOW OF VERY DILUTE GASES. (Over de Stationnaire Strooming van Zeer Verdune Gassen). P. Clausing. Translated from Physica 9, 65-80(1929). 20p.

The stationary flow for very dilute gases has been calculated for short tubes with large cross sections. The "cosine-law" for the gas-molecules reflection from the tube wall was assumed as valid. The general form of $K = W \times S_{\nu}$ is given in which K is the number of molecules flowing, per second, from a disk through a capillary tube of S cross section to the second disk. It is assumed that there is a negligible gas pressure in the second disk when the first disk is struck by ν_1 molecules per cm^2/sec. W is the probability that the molecule which enters the tube from the first disk will impinge directly to the second disk. The above equation may be applied for tubes of arbitrary length-cross section ratios. (R.V.J.)

8347 AEC-tr-2551

THE DIFFERENCE METHOD FOR SOLVING DIFFERENTIAL EQUATIONS OF NON-STATIONARY HEAT CONDUCTION, DIFFUSION AND IMPULSE PROPAGATION. Ernst Schmidt. Translated from Forsch. Gebiete Ingenieurw. 13, 177-85(1952). 17p.

8348 AERE-Lib/Trans-710

THE DISTRIBUTION OF HEAT IN A TWO-PHASE SYSTEM FOR A SPECIFIED EQUATION OF MOTION OF THE PHASE BOUNDARY. G. A. Martynov. Translated by R. C. Murray from Zhur. Tekh. Fiz. 25, 1754-67(1955). 17p.

Determination of the depth of freezing of moist soils, the thickness of ice on the water surface, and the rate of solidification of casting involve a mathematical problem for determination of the temperature field in a two-phase system and the equation of motion of the phase boundary for specific initial and boundary conditions. A simplified method has been offered in which investigations are made of the temperature at stationary boundary (boundary conditions) and its value in the medium. The system of integral content was resolved into two sub-systems, each of which described the process only in one phase thus determining the heat in two regions with moving interface, the equation of whose motion is known. In turning from the direct-to-inverse method, the integral equations are converted from functional into ordinary equations. This method considerably eases the calculations and provides accurate solutions in general form, at least for the cases when equation of motion of the interface is given by $h = vt^{1/2}$ and initial conditions are analytical function of the coordinates. (auth)

8349

HOW TO DESIGN THE OPTIMUM HEAT EXCHANGER—15 STEPS. M. T. Cichelli and M. S. Brinn (E. I. du Pont de Nemours & Co., Wilmington, Del.). Chem. Eng. 63, No. 5, 196-200(1956) May.

Equations were developed for evaluating the following design characteristics of shell-and-tube heat exchangers for optimum performance: total surface area, warm-end temperature approach, number and length of tubes, baffle spacing, and tube-side and shell-side pressure drop. (C.W.H.)

Refer also to abstract 8233.

MATERIALS TESTING

8350 NP-5935

Mine Safety Appliances Co., Callery, Penna.

NITROGEN CONTAINING TWO PER CENT OXYGEN AS A SODIUM SYSTEM COVER GAS. Technical Report No. 49. E. F. Batutis, J. W. Mausteller, and C. A. Palladino. Apr. 10, 1956. 22p. Contract NObs-65426.

Nitrogen containing 2 vol. % O_2 is not recommended as a cover gas for sodium systems. Nitriding was general throughout the loop that was tested and plugged gas and drain lines were also found. (F.S.)

8351 NP-6045

Standard Oil Co. of Indiana, Whiting.

DEVELOPMENT OF THICKENERS FOR HIGH TEMPERATURE GREASES. Quarterly Progress Report No. 20 [for] April 10, 1956 to July 10, 1956. Robert S. Barnes and John C. Goossens. July 1956. 9p. Contract AF33(038)-23687.

Monthly Progress Report No. 62 is incorporated with this report and will not be submitted separately.

Thickeners are being synthesized and evaluated for use in greases in the temperature range 450 to 700°F. Syntheses involving urea, copper phthalocyanine, pteridine, and melamine are briefly described. Several glass-fiber thickened greases were tested. (For preceding period see NP-6004.) (C.W.H.)

8352 NP-6048

Goodrich (B.F.) Co., Akron, Ohio.

DEVELOPMENT OF INORGANIC POLYMER SYSTEMS. Quarterly Report No. II [for] March 1, 1956 to May 31, 1956. Carlin F. Gibbs, Harold Tucker, George Shkapenko, and John C. Park. May 1956. 23p. Project No. 7340. Contract AF33(616)-2744.

Chemical reactions leading to the formation of Al–Si–O polymers were investigated. Studies were continued on the steric effect of tertiary-butyl on exchange and condensation reactions between Si and Al compounds and on interactions of silanediolates of Na and K with difunctional Al halide compounds. (C.W.H.)

8353 WADC-TR-53-426(Pt. 3)

Iowa State Coll., Ames.

ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH-TEMPERATURE LUBRICANTS AND RELATED MATERIALS. Henry Gilman and Richard D. Gorsich.

Jan. 1956. 156p. Task Title: HYDRAULIC FLUIDS AND LUBRICANTS. Contract AF 33(616)-94.

The thermal stabilities of additional organo-metallic and organo-metalloidal compounds were investigated. Heterocyclic compounds containing Si or Ge appeared to be sufficiently stable to be used as high-temperature lubricants. In addition, compounds containing biphenylyl, phenoxyaryl, long-chained alkyl, or haloaryl groups also exhibited good thermal stabilities. Viscosity data are included. New synthetic procedures are outlined for several cyclic compounds. (C.W.H.)

8354 WADC-TR-55-164

Cornell Aeronautical Lab., Inc., Buffalo.

A STUDY OF THE TENSILE AND CREEP-RUPTURE PROPERTIES OF FIFTEEN HEATS OF C-110M TITANIUM ALLOY SHEET. [Period covered] January 15, 1954 to March 15, 1955. Frank J. Gillig and Glen J. Guarnieri. Jan. 1956. 70p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS. Contract AF33(616)-2342.

Fifteen heats of Ti alloy RC-130-A (C110-M) have been sampled and tested at room and elevated temperatures. These data are analyzed for reproducibility and relationships between the room-temperature and high-temperature properties at 500°F and 700°F. The results indicate that a correlation exists between the room-temperature strength properties and the yield and ultimate strengths at 500 and 700°F. However, the creep and rupture properties appear to be independent of the short-time tensile strength results even at 700°F, which was the temperature used for creep testing. (auth)

8355

AUTORADIOGRAPHIC METHODS IN POWDER METALLURGY. G. F. Huettig and G. Glawitsch (Institut f. Anorganische u. Physikalische Chemie, Tech. Hochschule Graz, Austria). Powder Met. Bull. 7, 108-12(1956) Apr.

The possibilities, limitations, and examples of autoradiographic methods of analysis for powder metallurgy are surveyed. (F.S.)

PUMPS

8356

DEVELOPMENT OF GLANDLESS PUMPS. J. R. Allard (Hayward-Tyler and Co., Ltd.). Nuclear Eng. 1, 28-30(1956) Apr.

Glandless pumps while eliminating leakage of the circulating fluid introduce special problems of insulation and bearing design. Two types of pump currently manufactured by Hayward-Tyler and Westinghouse respectively are taken as examples of the methods used to overcome these difficulties. (auth)

VACUUM SYSTEMS

8357 NP-6050

Mine Safety Appliances Co., Callery, Penna.

TWO INCH STOP VALVE TESTS WITH SODIUM. Memo Report 107. G. E. Kennedy and E. C. King. Mar. 5, 1956. 5p. Contract NObs-65426.

The integrity of the bellows of the 2 in. stop valve on the S2G drain system was determined during freezing and thawing of sodium following a dump operation into the hold tanks. The valve was so positioned that a minimum of sodium should be held up in it. The test was run three times to determine whether subsequent freezing and thawing of the residual sodium would cause failure of the bellows. The valve performed satisfactorily. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

8358

NUCLEAR METALLURGY—A SYMPOSIUM ON BEHAVIOR OF MATERIALS IN REACTOR ENVIRONMENT, FEBRUARY 20, 1956. New York, American Institute of Mining and Metallurgical Engineers, 1956. 94p. $3.75.

The following papers describing the peculiar problems and fields of application of commercial metallurgical materials were read: applications of materials in reactor environments; material behavior in liquid metals; application of materials in low-temperature water power reactor; corrosion of materials in fused hydroxides. (F.S.)

CERAMICS AND REFRACTORIES

8359 AD-31941

Fansteel Metallurgical Corp., North Chicago, Ill.

INVESTIGATION TO DETERMINE SUITABLE COATINGS FOR MOLYBDENUM. Final Technical Progress Report for Period November 1, 1950 to November 1, 1952. James R. Darnell and Ralph F. Wehrmann. Feb. 4, 1953. 63p. Contract NOa(s) 51-111-c.

Powder metallurgy was used to prepare $MoSi_2$ bodies with added Ni, Cu or Al. Added Ni produced alloys with the highest physical rupture. Modulus of rupture up to 39,000 psi and harndess of 84 Rockwell A were obtained. Added Al provided the best oxidation resistance. Silicon coatings with Ni, Cu, Co, and/or B were applied to Mo by the paint and sinter method but these were not as resistant to oxidation as the $MoSi_2$ coatings produced by the vapor phase method. Hot dipping followed by flame spraying appeared to be a promising procedure for coatings. (F.S.)

8360 BMI-1102

Battelle Memorial Inst., Columbus, Ohio.

THE THERMAL FRACTURE OF CERAMIC CYLINDERS. Allison K. Smalley, Eugene M. Baroody, Eugene M. Simons, and Winston H. Duckworth. June 28, 1956. 44p. Contract W-7405-eng-92. $0.35(OTS).

Theoretical and experimental work indicated that the nonaxial heat flow per unit length, W_{max}, required to fracture a hollow ceramic cylinder could be represented by the product of two separate factors, M and S, characterizing the material and the shape, respectively. The relationship, $W_{max} = MS$, was shown to be valid for cylinders having circular, square, or triangular outer peripheries. The effect of specimen dimensions on the shape factor, S, of circular cylinders was determined experimentally, and was found to be consistent with theoretical expectations. Similarly, the experimentally determined relative shape factors for the three specimen geometries were in agreement with those predicted by theory. Absolute material factors for six types of ceramic bodies were approximated. The effect of specimen temperature on material factor was shown experimentally to be negligible over the temperature ranges examined for a sintered ruby, a SiC body, and a high-alumina porcelain. (auth)

8361 BMI-1106

Battelle Memorial Inst., Columbus, Ohio.

SOME PROPERTIES OF TANTALA SYSTEMS. Burnham W. King, John Schultz, Edmund A. Durbin, and Winston H. Duckworth. July 9, 1956. 42p. Contract W-7405-eng-92. $0.30(OTS).

Four two-component oxide systems involving Ta_2O_5 with Na_2O, MgO, Al_2O_3, or ZrO_2 were studied to provide a basis for their consideration in developing new and useful

ceramics. In the $Na_2O-Ta_2O_5$ system, three distinct phases were identified: the compound $Na_2O \cdot Ta_2O_5$, a Phase Y having the apparent composition $3Na_2O \cdot Ta_2O_5$, and a Phase X with a composition between $Na_2O \cdot Ta_2O_5$ and $Na_2O \cdot 3Ta_2O_5$. A solid solution existed between the two latter compositions. Several compositions in this field formed crystals with structures of the perovskite type. $Na_2O \cdot Ta_2O_5$ was the most refractory of these, having an approximate fusion temperature of 3200°F. Three phases also were found in the $MgO-Ta_2O_5$ system: $MgO \cdot Ta_2O_5$, a Phase S with the apparent composition $4MgO \cdot Ta_2O_5$, and a Phase W which melted incongruently at 3000 to 3100°F to form Phase S and $MgO \cdot Ta_2O_5$. Phase S fused at about 3320°F. In the $Al_2O_3-Ta_2O_5$ system, a solid solution existed in the range between about 50 and 70 mol % of Al_2O_3. All compositions in this range had lattice constants and refractive indexes which were practically constant with varying composition. A compound was discovered in the $ZrO_2-Ta_2O_5$ system at the composition $6ZrO_2 \cdot Ta_2O_5$. Several compositions with good sintering properties existed in the $MgO-Ta_2O_5$ systems. Bodies of low porosity also were produced in the $Al_2O_3-Ta_2O_5$ systems. It was difficult to produce bodies of low porosity in the $Na_2O-Ta_2O_5$ system except by hot pressing. Small additions of Na_2O, Al_2O_3, or ZrO_2 caused the low-temperature (beta) form of Ta_2O_5 to be retained at room temperature after firing above its transformation point. Pure Ta_2O_5 inverted below 2600°F (2410 ± 30°F according to previous investigators). Tantalate compounds which might warrant investigation for refractory applications are: $MgO \cdot Ta_2O_5$, $4MgO \cdot Ta_2O_5$, and $6ZrO_2 \cdot Ta_2O_5$. Two-component tantalate compositions which yielded refractory solid-solution phases contained 50 to 70 mol % of Al_2O_3, 0 to 10 mol % of Al_2O_3, 66 to 86 mol % of ZrO_2, or 0 to 20 mol % of ZrO_2. Perovskite structures, indicative of useful electrical properties, were found in the compounds $Na_2O \cdot Ta_2O_5$, $Na_2O \cdot 2Ta_2O_5$, and $Na_2O \cdot 3Ta_2O_5$, and also in the ternary system $Na_2O-Al_2O_3-Ta_2O_5$. (auth)

8362 IGE-R-13

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

PRELIMINARY REPORT ON SHIELDING ECONOMICS. E. W. Sidebotham and T. Standen. Feb. 24, 1956. 23p. (IGC-EMC/P-52; IGC-SWP/P-29)

Some of the more recent works on shielding economics are reviewed. Prices of materials which may be of use in shielding are quoted, and a collection of published shielding data is presented. The relative merits of different materials as shields are investigated, and a program of work to be done is proposed. (auth)

8363 AEC-tr-2532

MELTING POINT DIAGRAMS OF HIGHLY REFRACTORY OXIDES. VII. SYSTEMS WITH CaO AND BeO. H. V. Wartenberg, H. J. Reusch, and E. Saran. Translated by I. A. Warheit from Z. anorg. u. allgem. Chem. 230, 257-76 (1937). 24p.

Melting point diagrams are presented for the highly refractory oxides. The CaO and BeO systems were investigated by observing the temperatures of softening and the drop formations of rods of these mixtures. (W.L.H.)

8364

CERAMICS FOR NUCLEAR POWER APPLICATIONS. L. R. McCreight and H. G. Sowman (Knolls Atomic Power Lab., Schenectady, N. Y.). Am. Ceram. Soc. Bull. 35, 176-9 (1956) May.

8365

MOLYBDENUM DISILICIDE FOR HIGH TEMPERATURE SERVICE. Metallurgia 53, 175(1956) Apr.

$MoSi_2$ has outstanding high-temperature strength, and corrosion and oxidation resistance. It may be cast, pressed, extruded, rolled or molded. Poor thermal shock resistance is its major deficiency. (F.S.)

8366

PREPARATION AND EVALUATION OF Cr-Ti-O COMPOSITIONS. William Arbiter (American Electro Metal Corp., Yonkers, N. Y.). Powder Met. Bull. 7, 65-8(1956) Apr.

Cr-O-Ti systems were investigated for high-temperature jet applications. Values were found for density, electrical resistance, hardness, modulus of rupture, impact resistance and oxidation resistance. Poor impact resistance would indicate that Cr-O-Ti systems would not be feasible in jet application. (F.S.)

8367

MATERIALS FOR VERY HIGH TEMPERATURES. R. Steinitz (Schwarzkopf Development Corp., Yonkers, N. Y.). Powder Met. Bull. 7, 155-8(1956) Apr.

Survey of metals available for use in high temperatures is made. Oxides are considered but are unstable losing O below the stoichiometric ratio. Carbides, borides, and silicides can withstand sudden heating and cooling but they lack oxidation resistance. Other combinations and pure metals are considered. (F.S.)

8368

THE STABILITY OF BERYLLIA AND MAGNESIA IN DIFFERENT ATMOSPHERES AT HIGH TEMPERATURES. D. T. Livey and P. Murray (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 202-12(1956) Mar.

The behaviour of beryllia and magnesia under various conditions of atmosphere at high temperatures is discussed. Beryllia volatilizes readily in the presence of water vapour whereas magnesia does not. This is in conformity with the general higher stability of gaseous beryllium compounds compared with those of magnesium. In vacuo or in reducing atmospheres, magnesia volatilizes readily and this obviates its use as a high-temperature material under these conditions. Beryllia however is stable under these conditions. Calculations are made using the Knudsen relationship on the rates of loss in weight to be expected under equilibrium conditions for the various atmospheres mentioned above, and these are shown to account for the losses observed experimentally. (auth)

CORROSION

8369 BM-RI-5201

Bureau of Mines.

GALVANIC CORROSION PROPERTIES OF TITANIUM AND ZIRCONIUM IN VARIOUS INORGANIC SOLUTIONS. David Schlain, C. B. Kenahan, and Doris V. Steele. May 1955. 64p.

The galvanic corrosion properties of Ti and Zr were investigated. The dissimilar metals involved in these experiments included Mg, Mg alloy FS1, Al alloys, Zn, steel, Sn, Pb, Cu, Monel, Ni, and several stainless steels. Couples were immersed in synthetic ocean water, tap water, 5% ammonium sulfate solution, 5½% NaCl solution, NaOH solution, 0.1N HCl, and various concentrations of H_2SO_4. Electrode potential measurements and several types of galvanic couple experiments were carried out. Solutions were aerated by three methods, flow of air, flow of helium, and natural aeration. Most of the work was done at 35°C with couples consisting of equal areas of the two metals. However, some work was done at 60°C, and the effect of unequal specimen areas was studied briefly. Titanium and Zr usually resisted corrosion, whether alone or in contact with a dissimilar metal. Titanium corroded in some H_2SO_4 solutions. Contact with Ti or Zr in various solutions often

caused other metals to corrode by galvanic action. Contact with Al alloys in certain solutions in which Ti is ordinarily inert and noble with respect to the Al alloys caused Ti to corrode. Contact with stainless steels in some solutions in which Ti is anodic decreased the usual corrosion rate of Ti. (auth)

8370 CF-56-4-139
Oak Ridge National Lab., Tenn.
HRP DYNAMIC SLURRY CORROSION STUDIES: QUARTER ENDING APRIL 30, 1956. E. L. Compere, H. C. Savage, S. A. Reed, G. E. Moore, R. M. Warner, R. M. Pierce, and S. R. Buxton. Apr. 30, 1956. 28p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Corrosion data and operational information are presented for 2 slurry run at 300°C in which a specially pure ThO_2 was circulated for 312 hr at concentrations of from 440 to 1008 g Th/kg H_2O. The concentration was increased from the lower to the higher level in four increments using a recently developed slurry addition device. The developmental in-pile slurry loop made several runs on water to evaluate proposed systems for providing condensate for purge water to the 5 gpm pump. Toroid results indicate that attack rates on stainless steel, Ti, and Zircaloy are dependent on circulation velocity and on ultimate particle size, but not on temperature of calcination of the oxide. (For preceding period see CF-56-1-168.) (auth)

8371 HW-41797
Hanford Atomic Products Operation, Richland, Wash.
THE INTERGRANULAR CORROSION OF ALUMINUM IN SUPERHEATED STEAM. C. Groot and R. E. Wilson. May 17, 1956. 18p. Contract W-31-109-Eng-52. $4.80 (ph OTS); $2.70(mf OTS).

The limits of strength and corrosion resistance intergranular corrosion are considered. Uniform corrosion could become more rapid than allowable for many applications even though the temperature and pressure were in a region where intergranular attack did not occur. From the data it is apparent that Alcoa alloy M-388 is not limited below 375°C at 2500 psig. At 400 psig the limiting temperature is about 450°C. For 2S the temperature limit is about 200°C in saturated steam or water and about 250°C for 400 psig steam. Therefore, 2S is not very useful with superheated steam. (auth)

8372 NP-6044
Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.
CORROSION OF COPPER IN SULFURIC ACID. Technical Report No. XVIII. Neldon L. Jensen and Milton E. Wadsworth. July 16, 1956. 60p. Project NR-051-192. Contract N7-onr-45103.

The corrosion of Cu in H_2SO_4 solutions was investigated, and the rate of corrosion was measured by determining the amount of cupric ion in the solution at various periods of time, and under known conditions. The rate was determined as a function of time, agitation of the solution, acid concentration, and partial pressure of O_2. A mechanism was postulated that satisfied the experimental observations. The corrosion of Cu was found to be linear over the range of time under all the conditions investigated, and the rate was observed to be directly proportional to the partial pressure of O_2. The rate, as a function of H_2SO_4, indicated an adsorption process in which the active adsorbate was undissociated H_2SO_4. Calculations of the energy of activation for the over-all process using the Arrhenius equation was found to be 14.2 kcal per mole. The rate-determining portion of the process was considered to be the adsorption of undissociated H_2SO_4, followed by a rearrangement on the surface. The adsorbed species reacted with molecular O_2 and decomposed through an activated complex into the products of the reaction. The net reaction was considered to be $2\,Cu + H_2SO_4 + O_2 + 2H^+ \rightleftharpoons 2\,Cu^{++} + SO_4^{=} + 2H_2O$. The data were correlated by applying the Eyring theory of absolute reaction rates. (auth)

8373 NP-6051
Mine Safety Appliances Co., Callery, Penna.
CORROSION OF LOW ALLOY STEEL IN HOT NaK. Memo Report 109. W. Milich and E. C. King. Mar. 30, 1956. 6p. Contract NObs-65426.

Consideration is being given to the use of low alloy steels due to the difficulties encountered in the use of type 347 stainless steel for steam generating equipment. As a preliminary experiment, to check the corrosion of such steels by liquid metals, a type 304 stainless steel loop was revised to accomodate a section of 1 in. OD tubing composed of $2\frac{1}{4}$% Cr−1% Mo steel. NaK (56 wt. % K) at 850°F was circulated at approximately 8 ft/sec. through this tubing for four months. Four small samples ($\frac{1}{4}$ in. weighed sections of the tubing) placed in an in-stream expansion tank were removed after 1, 2, 3, and 4 months immersion time and showed penetration of 0.19, 0.09, 0.07, and 0.06 mils/yr respectively. The section of test tubing showed no detectable weight loss after the 4 month period. With the temperature of the NaK at 850°F the oxygen content was found to be 0.032 wt. % O_2. All results of the test run isothermally at 850°F indicated a rate of attack less than one mil per year. (auth)

8374
PROTECTIVE FILM ON TITANIUM IN HYDROCHLORIC ACID. Rikuro Otsuka. J. Sci. Research Inst. (Tokyo) 49, 319-24(1955) Dec.

Titanium immersed in hydrochloric acid solution is coated with titanium-hydride film, and this film shows a protective effect against the acid. Titanium coated with hydride film by pre-treatment of cathodic hydridation resists completely up to approximately 24 wt.% HCl at a room temperature. (auth)

8375
POWDER METALLURGY AND THE FIGHT AGAINST CORROSION. R. L. Meyer (Societe d'Electrochimie d'Ugine, Grenoble, France). Powder Met. Bull. 7, 124-9 (1956) Apr.

Application of the usual anticorrosion measures to the products of powder metallurgy, production of new materials having a good resistance to certain types of corrosion, and the use of metal powder in anticorrosion coatings are the methods by which the powder metallurgy industry is fighting corrosion. (F.S.)

GEOLOGY AND MINERALOGY

8376
PHOTOGEOLOGIC MAP OF THE SPRINGDALE NE QUADRANGLE, KANE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-148. C. L. Pillmore. Washington, U. S. Geological Survey, 1956. $0.50.

8377
PHOTOGEOLOGIC MAP OF THE VIRGIN NW QUADRANGLE, WASHINGTON COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-149. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

8378
PHOTOGEOLOGIC MAP OF THE WHITE CANYON-8 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-150. P. P. Orkild. Washington, U. S. Geological Survey, 1956. $0.50.

8379
PHOTOGEOLOGIC MAP OF THE ELK RIDGE-4 QUAD-

RANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-151. J. S. Detterman and J. N. Platt. Washington, U. S. Geological Survey, 1956. $0.50.

8380

PHOTOGEOLOGIC MAP OF THE ELK RIDGE-5 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-152. V. H. Sable. Washington, U. S. Geological Survey, 1956. $0.50.

8381

PHOTOGEOLOGIC MAP OF THE SHORT CREEK SE QUADRANGLE, MOHAVE COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-153. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

8382

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-13 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-154. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

8383

PHOTOGEOLOGIC MAP OF THE MOUNT PEALE-9 QUADRANGLE, SAN JUAN COUNTY, UTAH, MONTROSE AND SAN MIGUEL COUNTIES, COLORADO. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-157. R. J. Hackman. Washington, U. S. Geological Survey, 1956. $0.50.

8384

PHOTOGEOLOGIC MAP OF THE MOUNT PEALE-10 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-158. R. J. Hackman. Washington, U. S. Geological Survey, 1956. $0.50.

8385

PHOTOGEOLOGIC MAP OF THE FREDONIA SW QUADRANGLE, MOHAVE COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-160. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

8386

PHOTOGEOLOGIC MAP OF THE VIRGIN NE QUADRANGLE, WASHINGTON COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-161. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

8387

PHOTOGEOLOGIC MAP OF THE TIDWELL-2 QUADRANGLE, EMERY AND GRAND COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-162. V. H. Sable. Washington, U. S. Geological Survey, 1956. $0.50.

8388

PHOTOGEOLOGIC MAP OF THE WHITE CANYON-7 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-163. P. P. Orkild. Washington, U. S. Geological Survey, 1956. $0.50.

8389

PHOTOGEOLOGIC MAP OF THE JOHNSON SW QUADRANGLE, KANE COUNTY, UTAH, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-164. J. S. Detterman. Washington, U. S. Geological Survey, 1956. $0.50.

8390

ESTIMATION OF THE GEOLOGIC AGE OF RADIOACTIVE SEDIMENT CONTAINING RADIUM ISOTOPES. Hitoshi Sakai (Tokyo Univ., Tokyo). Bull. Chem. Soc. Japan 28, 509-14(1955) Sept.

Three procedures are suggested for the estimation of sedimentation rate as well as sedimentation intensity of radioactive sediments. These procedures are based on the time variation of the abundance ratios of Ra isotopes in the sediments. (auth)

8391

THE CYCLE OF CARBON AND THE STABLE CARBON ISOTOPES. Frans E. Wickman (Naturhistoriska Riksmuseets, Stockholm, Sweden). Geochim. et Cosmochim. Acta 9, 136-53(1956) Mar.

The following estimates are used: carbonate carbon (A) 2420 ± 560 grams, $C^{12}/C^{13} = 88{\cdot}55 \pm 0{\cdot}05$; organic sedimentary carbon (B) between 0·1–0·5 per cent C in shales, $C^{12}/C^{13} = 91{\cdot}00 \pm 0{\cdot}10$. The concept "crustal carbon" is defined, and based on the measurements of the isotope ratios of thirty-seven diamonds, nineteen carbonates from Ivigtut, some other carbonates and some graphites: the isotope ratio of crustal carbon is estimated to be $89{\cdot}11 \pm 0{\cdot}05$. Using these isotope ratios, the ratio A/B is found to be $3{\cdot}45 \pm 0{\cdot}55$, and B = 700 ± 200 grams. All weights are referred to cm^2 earth surface, and the isotope ratios to the Stockholm scale. (auth)

8392

RADIOACTIVITY AND URANIUM CONTENT OF CRETACEOUS SHALES, CENTRAL GREAT PLAINS. Harry A. Tourtelot (U. S. Geological Survey, Denver, Colo.). Bull. Am. Assoc. Petroleum Geol. 40, 62-83(1956) Jan.

The Sharon Springs member of the Pierre shale of Late Cretaceous age, a hard black organic-rich shale, similar in many characteristics to the Chattanooga shale, is radioactive throughout central and western South Dakota, most of Nebraska, northern Kansas, and northeastern Colorado. In the Missouri River valley, thin beds of the shale contain as much as 0.01% uranium. Beds correlated with the Sharon Springs are as much as 20 ft thick or more and have a radioactivity of about 0.01% equivalent uranium in southwestern Nebraska according to interpretation of gamma-ray well logs. The radioactivity and uranium content are highest in the Missouri River valley in South Dakota and in southwestern Nebraska where the shale rests disconformably on the underlying Niobrara formation, also of Cretaceous age. Near the Black Hills, and in the area on the north, the shale of the Sharon Springs member rests on a wedge of the Gammon ferruginous member of the Pierre, which is represented by a disconformity on the east and south, and the radioactivity of the shale is low although greater than that of overlying strata. In the Great Plains region, the greatest radioactivity occurs in masses of unaltered shale measuring about 1 × 4 feet in cross section included in the lower part of the altered zone. Where the zone is made up of shale and marl of the Niobrara formation, parts of the included unaltered shale contain as much as 0.1% equivalent uranium and 0.03% uranium. The disequilibrium between equivalent uranium (radioactivity) and the uranium content of the shales is believed to be a surface feature caused by relatively recent leaching of uranium from the present out-crops. The co-extensive distribution of the altered Cretaceous zone and of the overlying White River group suggests that most of the uranium in the small masses of unaltered marl in the altered zone has been derived from the White River group. (auth)

8393

RADIOACTIVE DEPOSITS IN CALIFORNIA. George W. Walker, Tom G. Lovering, and Hal G. Stephens. Calif. Dept. Nat. Resources, Div. Mines, Spec. Rept. No. 49, Jan. 1956. 38p. $0.50.

Reconnaissance examination of many areas, mine properties, and prospects in California during the period between 1948 and 1954 by geologists of the U. S. Geological Survey and the U. S. Atomic Energy Commission has confirmed the presence of radioactive materials in place at more than 92 localities. Abnormally high radioactivity at these localities may be caused by concentrations of primary or secondary

uranium minerals, radon gas, radium, or thorium minerals. Of the known radioactive deposits, only 8 are thought to contain uranium oxide (uraninite or pitchblende), 4 contain uranium-bearing niobate, tantalate, or titanate minerals, 32 contain secondary uranium minerals, such as autunite, carnotite, and torbernite, 3 contain radon gas, 11 contain thorium materials, and, at the remaining localities, the source of the anomalous radiation was not determined. (auth)

8394
URANIFEROUS MAGNETITE-HEMATITE DEPOSIT AT THE PRINCE MINE, LINCOLN COUNTY, NEW MEXICO. George W. Walker and Frank W. Osterwald. Econ. Geol. 51, 213-22(1956) May.

A pyrometasomatic magnetite-hematite deposit in sedimentary rocks of Permian age near the margin of the Lone Mountain stock in Lincoln County, N. Mex., contains between 0.015% and 0.031% U. The deposit is composed mainly of magnetite with lesser amounts of hematite, hydrated iron oxides, pyrite, leuchtenbergite (?), gypsum, chalcopyrite, metatorbernite, torbernite(?), covellite, sphalerite(?), quartz, marcasite, and an unidentified U-bearing mineral; it is surrounded by an aureole of recrystallized limestone, gypsum, epidote, and actinolite with lesser amounts of specularite, phlogopite, fluorite, pyrite, and chalcopyrite. Autoradiographs and polished section studies suggest that most of the U is dispersed in the iron oxide minerals. The association of Fe and U may be related to the melting points of the elements. The deposit probably formed at a rather low temperature by self-oxidation of a ferrous hydroxide hydrosol contained in a mildly alkaline solution. (auth)

METALS AND METALLURGY

8395 A-2173(WEC)
Westinghouse Electric Corp. Aviation Gas Turbine Div., Kansas City, Mo.
DEVELOPMENT OF NIOBIUM BASE ALLOYS. Quarterly Progress Report No. 1 [for] Period January 15, 1956 to March 15, 1956. R. T. Begley and M. S. Fredenburg. Apr. 1956. 95p. Contract AF33(616)-3316.

The potentialities of Nb-base alloys for high-temperature structural application are being investigated. Arc melting of Nb–Cr and Nb–Fe sustems for phase diagram studies and the production of pure Nb by vapor deposition methods have been started. Tensile properties of annealed Nb for the range –196° to 600°C have been obtained. Development of analytical techniques for the determination of impurities in Nb was begun. (F.S.)

8396 AECU-3105
Tennessee. Univ., Knoxville.
A METALLOGRAPHIC AND X-RAY STUDY OF NICKEL ALLOYS OF 20–30 PERCENT MOLYBDENUM. Report No. 1. D. W. Stoffel and E. E. Stansbury. Dec. 1955. 98p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 582. $0.45(OTS).

Results of metallographic and x-ray studies on Ni base alloys containing Mo and the effects of additions of Cr were studied. Alloys prepared from high purity materials by induction melting and hot working were examined metallographically and with the X-ray spectrometer. Beta phase formation appears complicated by the fact that it is closely related in structure to alpha and tends to form by an ordering process. These phases form from alpha with a variety of structure ranging from fine precipitates to lamellar structures formed by growth and nucleation. (F.S.)

8397 AECU-3124
Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
THE EVOLUTION OF THE ENERGY STORED BY A GOLD–SILVER ALLOY COLD WORKED AT –195°C AND AT ROOM TEMPERATURE. Peter Greenfield and M. B. Bever. [1955]. 17p. Contract AT(30-1)-1002. $0.20(OTS).

The energy stored in an 82.6 gold-17.4 silver (by weight) alloy, cold worked at –195°C and at room temperature, has been measured by tin solution calorimetry. The effect of annealing upon the energy content retained by samples deformed at these temperatures has been investigated. The stored energy in samples worked at –195°C is shown to anneal out in two distinct stages, while after working at room temperature the stored energy is evolved in only one stage. The results are discussed in terms of the types of lattice imperfections produced by cold working. (auth)

8398 AECU-3143
Knolls Atomic Power Lab., Schenectady, N. Y.
GUIDE TO ALKALI METALS HANDLING. Liquid Metals Safety Committee Manual LMSC-1. W. W. Kendall, L. H. B. Peer, W. J. Scheiber, and F. C. Steiner. July 1, 1954. 33p. Contract W-31-109-Eng-52. $0.25(OTS).

8399 AF-TR-6731(Pt. 4)
Battelle Memorial Inst., Columbus, Ohio.
SHORT-TIME CREEP PROPERTIES OF STRUCTURAL SHEET MATERIALS FOR AIRCRAFT AND MISSILES. Covers work conducted from April 1954 to June 1955. John A. Van Echo, Damian V. Gullotti, James R. Bibler, and Ward F. Simmons. Jan. 1956. 70p. Project Title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task Title: DESIGN DATA FOR METALS. Contract AF 33(038)-8743.

Creep properties for RC-70 Ti, 61 S–T_6 and 75 S–T_6 Al alloys, SAE 4130 steel, alloy steel A-286, and 17-7 PH and Type 410 stainless were reported under short-time rapid heating conditions to simulate service conditions for supersonic aircraft and missiles. (F.S.)

8400 BM-RI-5247
Bureau of Mines.
FABRICATING CONSUMABLE ELECTRODES OF ZIRCONIUM, TITANIUM, AND SIMILAR METALS FOR ARC MELTING. R. A. Beall, F. W. Wood, and P. C. Magnusson. Aug. 1955. 28p.

Information on fabrication of consumable electrodes by sintering, nippling, and welding lightly pressed compacts of scrap metal is summarized. A possible savings of considerable capital invested is shown in the case of sintered compacts. The electrical circuit components of a pilot sintering unit are analyzed. The consumable-electrode arc-melting process for producing high quality pure or alloy ingot from sponge Ti or Zr is considered the best. (auth)

8401 BM-RI-5248
Bureau of Mines.
TITANIUM PLANT AT BOULDER CITY, NEV.: OPERATING COSTS. C. T. Baroch and T. B. Kaczmarek. Aug. 1955. 23p.

Cost data accumulated during 15 months of sustained operation of the Bureau of Mines Boulder City (Nev.) Ti plant, which had a capacity of about 1,350 lb of Ti sponge per day are summarized. In early 1953 the Defense Materials Procurement Agency contracted with the Bureau of Mines for producing approximately one-half million pounds of usable ductile Ti sponge. Production began in May 1953, ended in September 1954, and yielded 492,503 pounds of acceptable metal. Operating costs covering this period of operation, with suggested depreciation and administrative costs, are given, as well as outlines of building and equipment capital costs. In addition, miscellaneous economic considerations are discussed, including labor and operating-time schedules. (auth)

8402 BM-RI-5250

Bureau of Mines.

EXPERIMENTAL MAGNESIUM ALLOYS CONTAINING NICKEL, MANGANESE, LITHIUM, AND ALUMINUM. J. A. Rowland, C. E. Armantrout, and D. F. Walsh. Nov. 1955. 24p.

Mg alloys containing Ni, Ni and Mn, Li, Li and Mn and Li and Al were investigated. Melting, casting, and mechanical working techniques and the heat treatment of various compositions were studied. Amenability to cold and hot working was shown for many compositions. The Mg–Ni and Mg–Ni–Mn alloys failed to develop superior mechanical properties and were very low in resistance to corrosion. The Mg–Li series, although entirely plastic, had low strength properties. The addition of small amounts of Al to the Mg–Li base did not affect greatly either the ductility or the strength; further additions developed increased strength, but only at room temperature, and the alloys became brittle with age. Continued study, concentrating on the ductile Li-rich beta phase as a base composition for ternary and quaternary systems, is recommended. (auth)

8403 NAA-AL-2064-16

North American Aviation, Inc., Downey, Calif.

STATUS OF TITANIUM ALLOY DEVELOPMENT PROGRAM. Progress Report No. 17. Oct. 1, 1955. 38p. Contract AF33(600)-28469. (AD-81363)

The chemical composition and mechanical properties of various heats of Ti–4 Al–4V and Ti–6 Al–4V alloys are reviewed and tabulated. Formability tests, including free bend, stretch, forming, drop hammer, and joggle tests, showed that under equivalent conditions Ti–4 Al–4V alloy is more formable than Ti–6 Al–4V; that forming temperature should be in the range of 1200 to 1300°F to meet strength and design standards. The forming rates should be kept as slow as possible. Ceramic-coated kirksite dies for hot stretch forming Ti were studied. Only chemical composition and mechancal properties are tabulated for extruded Ti–Al–V and RC–A–110–AT parts. The Ti bolt has been studied and results of headings RS-140X, Ti-155A, and MST-6Al-4V at 1500 to 1700°F are shown in photographs. Fission weld of Ti–Al–V alloys was investigated. A welding machine control panel is described and photographs of the equipment and oscillographic recordings are presented. (R.V.J.)

8404 NAA-SR-1531

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ON THE ORDERING BEHAVIOR OF Cu–Au. C. J. Meechan and C. E. Dixon. July 15, 1956. 18p. Contract AT-11-1-GEN-8. $3.30(ph OTS); $2.40(mf OTS).

The effects of disordering temperature, cold work, and electron irradiation on the ordering rate of CuAu at 150 and 22°C were measured, using the electrical resistivity as a measure of the degree of order. Results of these treatments show that the ordering rate is increased by rapid quenching from above the critical temperature, cold working disordered samples, and irradiating disordered samples with 1-Mev electrons. The observed increased ordering rates are believed to be caused by the excess concentration of vacant lattice sites produced by the various treatments. (auth)

8405 NACA-TN-3660

Lewis Flight Propulsion Lab., Cleveland.

INVESTIGATION OF THE Ni_3Al PHASE OF NICKEL–ALUMINUM ALLOYS. Edward M. Grala. Apr. 1956. 24p.

An investigation was made to determine the effects of homogenization treatments and of composition on the tensile properties of as-cast alloys in the Ni_3Al-intermetallic-phase region. The 13.3%–Al alloy had an average as-cast room-temperature tensile strength of 28,650 psi with 1.0% elongation. After homogenization treatments at 1800°F, the room-temperature tensile strength decreased to 20,350 psi with 0.2% elongation. An alloy in the Ni_3Al-phase region containing 14% Al had better tensile properties than the stoichiometric composition (13.3% Al); the average as-cast room-temperature tensile strength was 39,250 psi, and the homogenized tensile strength was 32,100 psi. At 1500°F the average tensile strength for the 14% Al alloy was 19,600 psi. The stoichiometric Ni_3Al was not hot-workable and had moderate impact strength. The stress-rupture strengths were evaluated at 1500°, 1600°, and 1700°F for the 14%–Al alloy. The 100-hour rupture strength was interpolated as 8600 psi at 1500°F. (auth)

8406 NACA-TN-3727

Michigan. Univ., Ann Arbor.

INFLUENCE OF HOT-WORKING CONDITIONS ON HIGH-TEMPERATURE PROPERTIES OF A HEAT-RESISTANT ALLOY. John F. Ewing and J. W. Freeman. Aug. 1956. 134p.

A study was made to determine the influence of various hot-working conditions on the high-temperature properties of a heat-resistant alloy. The effects of hot-working on response to subsequent heat treatment were also studied. The working conditions varied were temperature, amount of reduction, and a combination of both. The evaluation of the effects of rolling was based on rupture and creep tests, hardness measurements, microstructural examination, and lattice-parameter measurements. (auth)

8407 NACA-TN-3728

Battelle Memorial Inst., Columbus, Ohio.

STUDY OF ALUMINUM DEFORMATION BY ELECTRON MICROSCOPY. A. P. Young, C. W. Melton, and C. M. Schwartz. Aug. 1956. 39p.

The slip-line structure in a series of Al single crystals at various stages during deformation was examined in an electron microscope. The slipline structure was also investigated in crystals strained after various degrees of prestraining. On the basis of the data from this study and from other investigations a theory is proposed for the deformation mechanism in Al crystals. The possible effects of short-range ordering on deformation modes are discussed. (NACA Abst.)

8408 NP-6041

Schwarzkopf Development Corp., Yonkers, N. Y.

CEMENTED BORIDES. Summary Progress Report for the Period August 1, 1955 to July 31, 1956. Ira Binder. (Includes two reprints: BORIDES OF RARE EARTH METALS. B. Post, D. Moskowitz, and F. W. Glaser. J. Am. Chem. Soc. 78, 1800-2(1956). and NEW BORIDES OF YTTRIUM. I[ra] Binder. Powder Met. Bull. 7, 74-5(1956)). 43p. Contract N6-ONR-256.

Borolite IV with varying compositions of Cr_2B and Cr–Mo alloy, exhibits high stress-to-rupture strengths up to 2000°F, excellent oxidation resistance and good heat shock resistance, but impact strength has been lacking. Attempts to correct this by coating have not been successful as the coat required to increase impact strength was very large. The particle size was investigated along with heat treatment, melting, and controlled impurity additions to improve impact strength. (For preceding period see NP-5766.) (W.L.H.)

8409 NP-6049

Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.

FURTHER ENGINEERING APPLICATIONS OF THE ABSOLUTE RATE THEORY TO THE CREEP OF LEAD. Technical Report LII. Mervin B. Hogan. June 15, 1956.

59p. Project NR-032-168. Contract N7-onr-45101.

Lead is extremely susceptible to both alloying elements and impurities as well as the physical treatment to which it has been subjected. The Absolute Rate Theory furnishes a most excellent engineering hypothesis with which to treat the creep of lead. The parameters K and α are basically average values derived from the overall data for the creep of any solid at a given temperature. The uniform elongation creep has the rate given by K sinh $\alpha \sigma_a$. This is of engineering importance since for time periods of engineering concern the resulting strain is so large that the initial transient creep is generally negligible. (auth)

8410 NRL-4797

Naval Research Lab., Washington, D. C.

EFFECT OF VACUUM DEGASSING ON PROPERTIES OF VARIOUS ALUMINUM ALLOYS. E. E. Layne and H. F. Bishop. June 26, 1956. 11p. Project Nos. NR 642-030 and NS 014-100.

The improvement in mechanical properties produced in various aluminum alloy castings as the result of vacuum degassing of the melts was determined for different melt compositions, section thicknesses, and mold media. It was shown that while mechanical properties are improved by the presence of grain refining additions and by rapid solidification such as occurs in thin sections and chill molds, further improvements in tensile strengths, yield strengths, and elongations are effected by the vacuum degassing treatment. (auth)

8411 NYO-7785

Aeroprojects, Inc., West Chester, Penna.

INVESTIGATION OF GRAIN REFINEMENT IN BERYLLIUM INGOTS RESULTING FROM THE APPLICATION OF ELASTIC VIBRATORY ENERGY DURING COOLING AND SOLIDIFICATION. Progress Report No. 6 Covering Period from May 1 to June 30, 1956. 17p. Contract AT(30-1)-1836. $3.30(ph OTS); $2.40(mf OTS).

An argon-vacuum-purging technique was incorporated in the treatment of Group III melts beginning with Melt No. 25 in an effort to minimize the gas inclusions observed in Group II melts. A Be radiation shield was inserted between the quartz and alundum tubes of the ultrasonic treatment furnace to minimize radiation heat loss and insure more efficient control of heat in the melt during treatment. (auth)

8412 WADC-TN-55-290

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

DEVELOPMENT OF CAST IRON-BASE ALLOYS OF AUSTENITIC TYPE FOR HIGH HEAT-RESISTANCE AND SCALE-RESISTANCE. Covers Period of Work from May 1954 to May 1955. F. Eberle, W. E. Leyda, W. Feduska, and F. B. Snyder. Oct. 1955. 72p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF 33(616)-2413.

In an investigation of over 100 investment-cast experimental alloys containing Fe, Cr, Ni, and Co to replace H.S. 21, a promising iron-base alloy was found. Its rupture strength at 1600 to 1800°F was 80 to 85% that of H.S. 21 but by increasing the W content relative to that of Nb and Ta and replacing part of the Ni by Co it is felt that the strength level can be raised. (F.S.)

8413 WADC-TR-53-24(Pt. 3)

Cornell Aeronautical Lab., Inc., Buffalo.

INTERMITTENT STRESSING AND HEATING TESTS OF AIRCRAFT STRUCTURAL METALS. Period Covered: October 1953 to August 1954. G. J. Guarnieri. Jan. 1956. 76p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task Title: DESIGN DATA FOR METALS. Contract AF 33(616)-2226.

Additional data have been gathered as part of a continuing program to evaluate the effect of intermittent load and temperature upon the high-temperature creep and rupture properties of aircraft structural alloys. The results obtained for the four alloys of 24S-T3 aluminum, RC-70 and RC-130-A titanium, and 4130 steel, when considered with respect to data previously reported for FS-1H magnesium, 321 stainless steel, Inconel X, and N-155, further emphasize that each alloy system behaves in its own characteristic manner when subjected to intermittent temperature and load. Data of the type being accumulated are of value to design engineers in the sense that some guidance is provided in the application of available static creep and rupture data to the construction of parts for intermittent service conditions. Emphasis in the test program is now turning towards consideration of effects of combined cycling of load and temperature inasmuch as the creep and rupture behavior has been established for eight alloys under the simpler conditions of constant temperature-constant load, constant temperature-intermittent load, and constant load-intermittent temperature. (auth)

8414 WADC-TR-53-336(Pt. 4)

California. Univ., Berkeley. Inst. of Engineering Research.

THE CREEP PROPERTIES OF METALS UNDER INTERMITTENT STRESSING AND HEATING CONDITIONS. PART 4. CREEP RESULTS FOR ALCLAD 7075-T6 ALUMINUM ALLOY AND COMPARISON WITH RESULTS FOR OTHER MATERIALS. [Period covered] October 1953 to October 1954. N. H. G. Daniels, H. B. Masuda, and John E. Dorn. May 1956. 100p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS. Contract AF33 (038)-11502.

A study of the creep properties of Al-clad aluminum alloy 75S-T6 under intermittent heating and loading conditions at 300 and 600°F and under intermittent heating conditions at 450° is reported. Test results were compared on a basis of net time at temperature under load. Intermittent cycles permitting recovery and overaging of material in the absence of load has a deleterious effect on creep resistance. Under other intermittent conditions the creep is approximately the same on a net time basis as the creep under steady load isothermal conditions. (F.S.)

8415 WADC-TR-54-109(Pt. 2)

Kentucky. Univ., Lexington. Kentucky Research Foundation.

SCALING OF TITANIUM AND TITANIUM ALLOYS. [Period covered] January 1, 1954 to June 1, 1955. H. J. Siegel, R. C. Duncan, Jr., and R. E. Swift. Nov. 1955. 109p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF18(600)-60.

A preliminary study of the scaling characteristics in air of experimentally produced Ti and Ti-base alloys was conducted at temperatures of 1200, 1400, 1600, and 1800°F (650, 760, 870, 980°C) in the time range of approximately four to three hundred hours. A total of 36 Ti-base alloys were scaled at each of these temperatures. Scales formed on all of the alloys at 1600°F were studied using x-ray diffraction. Scaling propensity of Ti-base alloys relative to unalloyed Ti were evaluated on the basis of weight gain with time. Isothermal transitions were noted for many of the alloys but were not studied in detail. An investigation of gaseous penetration in the commercial materials RC-70, RC-130A, and RC-130B was made at 1600° and 1800°F. (auth)

8416 WADC-TR-54-119

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

PROPERTIES OF XA78S ALUMINUM ALLOY SHEET,

PLATE AND EXTRUSIONS. Covers Period of Work from September 1951 to April 1953. H. W. Zoeller and R. E. Wittman. Feb. 1956. 108p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS.

Mechanical and metallurgical properties of XA78S aluminum alloy were studied. It has 10% greater strength than other alloys and corrosion resistance, fatigue strength, microstructure characteristics, response to heat treatment and spot welding properties are comparable to other Al-base alloys containing Zn, Mg and Cu. It offers greater resistance to bending and so forming will be more difficult. (F.S.)

8417 WADC-TR-54-472(Pt. 2)

Crucible Steel Co. of America. Research and Development Lab., Pittsburgh.

DEVELOPMENT OF AUSTENITIC IRON BASE SHEET ALLOY. Work Period from October 1954 to December 1955. Roy R. Rothermel. May. 1956. 24p. Project Title: METALLIC MATERIALS. Task Title: DEVELOPMENT OF AUSTENITIC IRON BASE SHEET ALLOY. Contract AF-33(616)-2047.

Results of the investigation of the weldability of a type II, AD30 alloy indicate that this material can be welded when adequate measures are taken to limit stresses set up during welding and where proper protection from the atmosphere is afforded the material during welding. Satisfactory welds were made in representative types of weld joints by the metallic arc process using types 310 and 312 mod. (2-3% Mo) electrodes and by the inert gas process using AD30 filler. Satisfactory welds were obtained by the butt flashwelding process. Bend test results of various welded specimens show good ductility, an evidence of formability of a welded section in the as-welded, solution treated condition. Short time tensile test results indicate welded specimens to have strengths (at a 1500°F testing temperature) comparable to the AD30 base material. (auth)

8418 WADC-TR-54-546

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

PILOT PRODUCTION OF PROMISING ELEVATED TEMPERATURE TITANIUM-BASE ALLOYS. Covers Period of Work from May 1, 1953 to March 31, 1955. Donald J. McPherson. Feb. 1956. 75p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2060.

Melting procedures and equipment to produce ingots weighing up to 100 pounds of promising Ti-base alloys developed are described. To furnish ingots of this size, the existing arc melting facilities were expanded. A nonconsumable electrode arc furnace of 20-pound capacity employing a magnetic field to direct the arc was designed and fabricated. The capacity of the consumable electrode furnace previously developed at Armour Research Foundation was increased to a theoretical maximum of 300 pounds of Ti by the incorporation of a continuous casting mechanism and increasing the diameter of the mold. Ingots weighing up to 113 pounds and up to 6 inches in diameter were successfully cast. Titanium-base alloy stock of 6% Al, 6% Al–4% V, 6% Al–0.5% Si, and 7% Al–3% Mo was supplied. It was recommended that the 6% Al–0.5% Si alloy be dropped from the program since it proved to embrittle upon exposure to elevated temperature creep conditions. In general, the 6% Al alloy was found to possess good creep resistance, good weld bend characteristics and satisfactory fatigue properties. With a load of 40,000 psi at 800°F for 300 hours, a creep extension 0.08% was obtained. An as-welded bend ductility of 3.5 T and endurance limits of 55,000 and 66,000 psi were found. The alloy meets several of the requirements originally listed as desirable for Ti-base alloys early in the program. (auth)

8419 WADC-TR-55-113

General Electric Co. Research Lab., Schenectady, N. Y.

TENSILE DEFORMATION OF ALUMINUM AS A FUNCTION OF TEMPERATURE, STRAIN RATE, AND GRAIN SIZE. R. P. Carreker, Jr. and W. R. Hibbard, Jr. July 1955. 27p. Project title: METALLIC MATERIALS. Task title: DEFORMATION MECHANISMS OF METALS. Contract AF-33(616)-2120.

True-stress, true-strain data are presented for two lots of high-purity aluminum annealed to produce several different grain sizes from each lot. The testing temperature range 20° to 873°K (0.021 to 0.94 T/Tm) was explored and the effect of strain rate was measured at 77 and 300°K. (auth)

8420 WADC-TR-55-114

General Electric Co. Research Lab., Schenectady, N. Y.

THE RELATIONSHIP OF HARDNESS MEASUREMENTS TO THE TENSILE AND COMPRESSION FLOW CURVES. R. E. Lenhart. June 1955. 14p. Project title: METALLIC MATERIALS. Task title: DEFORMATION MECHANISMS OF METALS. Contract AF 33(616)-2120.

The approximation of a uniaxial tensile stress flow curve from hardness measurements is possible by utilizing certain empirical conversion constants. Agreement of the tensile and hardness testing methods is possible upon metals such as aluminum, copper, and steel. Magnesium is not amenable to such a conversion of testing procedures. The presence of profuse twinning at low stress levels is believed to be the reason for unfavorable results in magnesium. (auth)

8421 WADC-TR-55-147

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

INCREASING THE RATIO OF MODULUS OF ELASTICITY TO THE DENSITY OF TITANIUM ALLOYS. Period Covered: March 1954 to March 1955. William H. Graft, David W. Levinson, and William Rostoker. Nov. 1955. 73p. Project title: METALLIC MATERIALS. Task Title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2355.

Alloy additions were examined for Ti to improve the elastic modulus-to-density ratio. Ti C and Ti B in their binary systems greatly improved elastic properties Ti_5Si_3 and TiBe only made minor improvements. (F.S.)

8422 WADC-TR-55-160(Pt.3)

Dow Chemical Co. [Magnesium Labs. Midland Mich.].

INVESTIGATION OF ALLOYS OF MAGNESIUM AND THEIR PROPERTIES. PART 3. THE ORIGIN OF THE DOUBLE PEAK IN THE TEXTURE OF CERTAIN ROLLED MAGNESIUM ALLOYS. Period Covered: February 1954 to February 1955. J. D. Wood, ed. Nov. 1955. 52p. Project title: METALLIC MATERIALS. Task title: IMPROVED MAGNESIUM ALLOYS. Contract AF 33(616)-2337.

In a study of inhomogeneous deformation in hot and cold rolled and extruded Mg and Mg alloys, basal slip and mechanical twinning seemed to be the most important deformation mechanisms involved in the generation of preferred orientation. Compression strains were modified by shear strain in such a way as to explain many of the experimental observations in a consistent manner. (F.S.)

8423 WADC-TR-55-218

National Research Corp., Cambridge, Mass.

INVESTIGATION OF NICKEL BASE PRECIPITATION HARDENING ALLOYS. Work Performed from August 10, 1953 to February 1, 1955. David I. Sinizer. Sept. 1955.

44p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF 33(616)-2144.

Vacuum-melted Waspaloy was made with controlled carbon content and varying ratios of Ti to Al. All nominal compositions were within the chemical specification ranges for commercial Waspaloy. Standard melting and casting procedures were satisfactory, except that an unusually large hot top appears necessary for producing sound ingots. All ingots forged readily. Increasing Ti/Al ratio from about 1.5 to 2.0 had no appreciable effect on rupture life or minimum creep rate at 1500°F for stresses from 30,000 to 35,000 psi. Both elongation and reduction of area at failure appeared to decrease with increasing Ti/Al ratio. None of the alloys were notch sensitive in stress-rupture at 52,500 psi and 1350°F. There was an indication of a minimum notch sensitivity at a Ti/Al ratio of about 2.0 for both stabilized and unstabilized vacuum-melted Waspaloy. (auth)

8424 WADC-TR-55-241
Dow Chemical Co., [Midland, Mich.].
NON-BASAL SLIP AND TWINNING IN POLYCRYSTALLINE MAGNESIUM AT ROOM TEMPERATURE. Aug. 1955. 27p. Project title: METALS AND METALLIC MATERIALS. Task title: THE EFFECT OF COMPOSITION AND INTERNAL STRUCTURE ON THE PROPERTIES OF METALS AND ALLOYS. Contract AF 33(616)-2511.

Identification was made and some understanding of observable deformation in polycrystalline magnesium at room temperature was gained. Basal slip, twinning, and detwinning are of primary importance in the early plastic strain range. Little or no correlation was found to exist between experimental observations and classical orientation criteria. (F.S.)

8425 WADC-TR-55-310
Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF GRAIN SIZE AND STRUCTURAL VARIABLES ON THE STABILIZATION OF TITANIUM ALLOYS. Covers Work from September 1954 to June 1955. Frank C. Holden, Horace R. Ogden, and Robert I. Jaffee. Jan. 1956. 56p. Project Title: METALLIC MATERIALS. Task Title: TITANIUM METALS AND ALLOYS. Contract AF 33(616)-412.

Studies made on the effects of alloy composition and heat treatment on the thermal stability of titanium alloys show that additions of molybdenum increase thermal stability of an alpha-beta alloy, whereas Cr decreases stability. Eutectoid decomposition products were observed in the microstructures of a Ti–5 Cr alloy after 200-hour aging at 800 or 1000°F. Oxygen additives increase strength and lower ductility, without a pronounced effect on thermal stability. Heat treatments to produce a thermally stable condition are most effective when the alloy has an acicular-type structure. This is most effectively accomplished by starting the stabilizing heat treatment in the beta field, although some improvement was observed when the alloy was originally worked in the beta field and stabilized in the alpha-beta. Exposure to a stress of 25,000 psi during aging at 600°F did not affect thermal stability. Stress-rupture tests did not indicate a strain-aging process in the conditions tested. (auth)

8426 WADC-TR-55-321
Sylvania Electric Products Inc., Bayside, N. Y.
RECRYSTALLIZATION OF TITANIUM. Summary of Work Performed During the Periods March 15, 1953 to February 28, 1954 and November 1, 1954 to May 31, 1955. L. S. Castleman, F. D. Rossi, and L. L. Seigle. Sept. 1955. 44p. Project title: METALLIC MATERIALS. Task No. 70627. Contract AF 33(616)-422.

An exploratory investigation was made of rates of nucleation and grain growth during the recrystallization of critically deformed sponge and iodide Ti. In arc-melted sponge Ti strained 2 to 3%, recrystallization occurred in bands, and because of non-uniform recrystallization it was impossible to determine nucleation rates. Rates of nucleation were measured approximately in arc-melted iodide Ti strained 2 to 3%, which recrystallized uniformly, and the activation energy for nucleation was determined to be 59,000 calories per mol. The energy of activation for grain growth in sponge Ti was about 52,000 calories per mol, and in iodide Ti 39,000 calories per mol, confirming the tendency of impurities to raise the activation energy for growth during recrystallization of a pure metal. (auth)

8427 WADC-TR-55-388
Michigan. Univ., Ann Arbor. Engineering Research Inst.
A SURVEY OF THE EFFECT OF AUSTENITIZING TEMPERATURE AND RATE OF CONTINUOUS COOLING ON THE STRUCTURE AND 700°F TO 122°F PROPERTIES OF THREE LOW-ALLOYED STEELS. Period Covered March 1954 to March 1955. Kenneth P. MacKay, A. Philip Coldren, Adron I. Rush, and James W. Freeman. Jan. 1956. 76p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF 33(038)-13496.

The relationships between microstructures formed with various cooling rates and austenitizing temperatures and properties at 700° to 1200°F were surveyed for three low-alloyed steels. The steels were Ni–Cr–Mo (SAE 4340), 1.25Cr–Mo–V ("17-22-A"S), and 3Cr–Mo–W–V (H-40). Martensite, martensitic-bainitic, bainitic, and bainitic-ferritic structures were produced by oil quenching 1-inch rounds and air cooling 1-inch simulated 3- and 6-inch rounds. Modifications of the oil-quenched and normalized structures of the 1-inch rounds resulted when the austenitizing temperature was raised from 1750° to 2100°F. The hardness level was maintained at 280–320 BHN by tempering the structures which had higher hardnesses in the as-transformed condition. The results indicated that the fully bainitic structures which were predominantly upper bainite had maximum strength over the range of testing temperature used. In general, such structures were found in the larger, normalized sections and with the higher austenitizing temperature. Since low values of ductility resulted from the higher temperature treatments, however, the best combinations of strength and ductility were obtained when the largest sections were normalized from the lower austenitizing temperatures (1750°F for SAE 4340 and "17-22-A"S, and 1950°F for H-40). Regarding the effect of varying the cooling rates of normalized bars, it was found that increases in strength occurred for all three steels as the effective bar diameter was increased from 1 inch to 6 inches. The effect of raising the austenitizig temperature from 1750° to 2100°F was to increase the strength, with the H-40 steel being affected the most. Ductility was lowered for all three steels as the heat-treating temperature was raised. (auth)

8428 WADC-TR-55-454(Pt. 1)
Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF FACTORS AFFECTING THE UNIFORM ELONGATION OF TITANIUM AND TITANIUM ALLOYS. [Period covered] December 1954 to June 1955. Frank C. Holden, Horace R. Ogden, and Robert I. Jaffee. Feb. 1956. 39p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33 (616)-2783.

The limits of uniform elongation were measured for typical alpha, alpha-beta, and beta Ti alloys. Each alloy was studied in three microstructural conditions over a temperature range from −75 to 300°C. Highest uniform

elongation was obtained for commercial Ti (alpha), whereas that for the beta-quenched Ti-7.5Cr-7.5Mo alloy was low. The presence of massive alpha in the alpha-beta alloys increases their uniform elongation. The dependence of uniform elongation on temperature is marked, particularly in the two-phase alloys. Maximum values were obtained at about 200°C. Measurements of uniform elongation from residual strain agree well with values of δ_{max} ; the values of the flow exponent n (from the flow equation $\sigma = B\delta_n$) are consistently higher. (auth)

8429

NEW BORIDES OF YTTRIUM. I. Binders (Schwarzkopf Development Corp., Yonkers, N. Y.). Powder Met. Bull. 7, 74-5(1956) Apr.

No borides with a B content greater than YB_6 have been found in a study of yttrium borides. Two borides with tetragonal-type structure were prepared. YB_4 has lattice parameters a = 7.09, c = 4.01A and YB_x has a = 3.78, c = 3.55A, x is believed to be 3. A hexagonal unit similar to the diboride structures of transition metals with a = 3.78, c = 4.40A is being studied. (F.S.)

8430

RECENT DEVELOPMENTS IN THE APPLICATION OF TRANSITION METAL BORIDES. Arnold Blum and William Ivanick (Borolite Corp., Yonkers, N. Y.). Powder Met. Bull. 7, 75-8(1956) Apr.

Some of the transition metal borides (CrB_2, ZrB_2, and MoB_2) have been described which are now being used widely for their outstanding liquid metal corrosion resistance, high-temperature stability in vacuum, and superior oxidation resistance at high temperatures. (F.S.)

8431

INVESTIGATION OF SINTERED METALS BY MEANS OF OVERVOLTAGE MEASUREMENTS. E. Cremer and P. Hittmair (Innsbruck Univ., Austria). Powder Met. Bull. 7, 82-7(1956) Apr.

The relationship of the catalytic activity of metals and the hydrogen overvoltage was used as a test for the surface activity of pressed and sintered carbonyl nickel and carbonyl cobalt powders. (F.S.)

8432

THE PRESENT STATUS OF MOLYBDENUM PRODUCTION. R. Kieffer and F. Benesovsky (Metallwerk Plansee, G. m. b. H., Reutte, Tyrol). Powder Met. Bull. 7, 113-21 (1956) Apr.

Essential features of high vacuum are casting and direct and indirect sintering processes are outlined and compared. Direct sintering produces very pure, gas free, readily deformable metal of small size at great cost. Indirect sintering procedures slightly porous, large grained structures of any size at a higher cost. Vacuum arc casting produces large sizes, easy addition of additives and better use of the scrap and cheaper Mo. (F.S.)

8433

STRUCTURES AND STRUCTURAL RELATIONS OF REFRACTORY METALLIC COMPOUNDS. Erwin Parthe (Mass. Inst. of Tech., Cambridge). Powder Met. Bull. 7, 138-45(1956) Apr.

The structures of carbides, nitrides, silicides, and suboxides have been studied with the aim of supplying general laws and structural relationships which should permit the prediction of new high-melting compounds. The following structural postulates have been recognized; bonding must be three dimensional and small structure elements must be dense packed. (F.S.)

8434

HOT HARDNESS OF SOME BINARY MOLYBDENUM BASE ALLOYS. Egon Pipitz (Schearzkopf Development Corp., Yonkers, N. Y.). Powder Met. Bull. 7, 146-8(1956) Apr.

The hot hardness of Mo–Ti, Mo–Zr, Mo–Nb, Mo–Ta, Mo–Cr, and Mo–W alloys has been investigated. These alloys are all within the range of solid solubility. (F.S.)

8435

REACTION OF TELLURIUM DIOXIDE AND SELENIUM TETRAFLUORIDE: PREPARATION OF TELLURIUM TETRAFLUORIDE. R. Campbell and P. L. Robinson (King's Coll., Newcastle upon Tyne, England). J. Chem. Soc., 785(1956) Mar.

8436

MECHANICAL PROPERTIES OF IODIDE TITANIUM. E. M. Savitskiĭ, M. A. Tylkina, and A. N. Turanskaya. Doklady Akad. Nauk S.S.S.R. 106, 254-7(1956). Jan. 11. (In Russian)

Investigations are made of iodide titanium stability and plasticity at temperatures up to 1200°C, and in various conditions of stress. (R.V.J.)

8437

INVESTIGATION OF CERTAIN PHYSICAL PROCESSES OCCURRING ON METAL SURFACES AT HIGH TEMPERATURE. Recrystallization in the subsurface layer of metals. Ya. E. Geguzin, and N. N. Ovcharenko (Kharkov State Univ.). Izvest. Akad. Nauk S.S.S.R. Otdel Tekh. Nauk No. 2, 3-14 (1956) Feb. (In Russian)

Investigations are made of recrystallization kinetics of grains in polycrystalline copper sample with interlacing microsection. Experiments showed that the natural roughness forming on the surface of the metal under certain conditions prolongs the mean time of the grain stabilization which produces a subsurface layer. The relation between the thickness of the sublayer and the mean size of the polycrystalline grain is studied. (R.V.J.)

8438

RADIOACTIVE METHODS FOR METALLOPHYSICAL INVESTIGATIONS. N. T. Gudtsov, L. I. Ivanov, and M. P. Matveeva. Vestnik Akad. Nauk S.S.S.R. 26, 79-83(1956) Mar. (In Russian)

Interactions between homogeneous and heterogeneous atoms and the binding force holding the atoms in the crystalline lattice of alloys were investigated. Several new methods are developed and special apparatuses were designed to determine the rate of evaporation, the elasticity of vapors and the thermal sublimation of metals in solid state. The radioactive isotope method makes possible the measurement of vapor pressures in metals with low vapor elasticity and in temperatures below melting point. The rate of evaporation on metal surfaces is measured by placing a sphere shaped induction-heated sample in a vacuum. Metallic vapors formed on the surface of the sample expand in the vacuum, reach and condense on a nitrogen-cooled target. The target is set to an exact position to the sample. The replacements of targets is accomplished by special instruments which make possible up to 40 target replacements during one experiment. The quantity of condensed metal vapors on targets is determined either by accurate weighing or by measuring the radioactivity of radioactive isotopes. Vapors of iron, cobalt, zinc, and other metals and alloys were tested. The evaporation and diffusion rate of alloy components limited the efficiency of the method. To study alloys, measurements are taken of the rate of saturated vapor escape from the chamber into a high vacuum through a calibrated opening. The evaporation rate and diffusion constants for pure and alloyed metals were determined on the principle of isotopic exchange between the samples containing the radioactive isotopes of the investigated metal and samples without such isotopes. Methods and design of the apparatus are described. (R.V.J.)

8439

THE CRYSTAL STRUCTURES OF $SrZn_5$ AND $BaZn_5$. N. C.

Baenziger and J. W. Conant (Univ. of Iowa, Iowa City). Acta Cryst. 9, 361-4(1956) Apr.

The crystal structures of $SrZn_5$ and $BaZn_5$ have been determined from Weissenberg and precession camera data. The orthorhombic unit-cell dimensions are for $SrZn_5$, a = 5.32, b = 6.72, c = 13.15 A, Z = 4, Pmcn; for $BaZn_5$, a = 5.32, b = 8.44, c = 10.78 A, Amam. The structures are related to the $CaZn_5$ structure. (auth)

8440

COMPOUNDS OF THORIUM WITH TRANSITION METALS. II. SYSTEMS WITH IRON, COBALT, AND NICKEL. John V. Florio, N. C. Baenziger, and R. E. Rundle (Iowa State Coll., Ames). Acta Cryst. 9, 367-72(1956) Apr.

The compositions of the compounds of Th with Fe, Co, Ni, and Cu have been summarized in a previous paper. Details of the structures of these compounds, together with a brief description of the structure determinations of the new structural types, are given here. Certain relationships among the compounds are noted. (auth)

8441

LATTICE PARAMETER AND COEFFICIENT OF THERMAL EXPANSION OF THORIUM. W. J. James and M. E. Straumanis (Univ. of Missouri School of Mines and Metallurgy, Rolla). Acta Cryst. 9, 376-9(1956) Apr.

Values of the lattice parameter of 99.86% pure thorium were determined by the asymmetric method over the temperature range +10 to +60°C, using copper radiation. A value of 5.0741 ± 0.0001 kX (5.0843 A) at 25°C, corrected for refraction, was obtained. The precision of the determination was better than 1:60,000. The computed closest atom-to-atom distance was 3.5952 A. The linear expansion coefficient was 11.6×10^{-6} $(°C)^{-1}$ for 10 to 60°C. The expansivity curve suggested some transition in the region of 38°C but no definite conclusion could be drawn. The calculated x-ray density at 25°C was 11.724 ± 0.004 g/cm^{-3}. (auth)

8442

THERMODYNAMIC PROPERTIES OF GASEOUS ZIRCONIUM. Harwood G. Kolsky (Los Alamos Scientific Lab., N. Mex.) and Paul W. Gilles (Univ. of Kansas, Lawrence). J. Chem. Phys. 24, 828-33(1956) Apr.

Tables of the thermodynamic properties of Zr considered as an ideal monatomic gas were calculated for a temperature range 0 to 8000°K. (auth)

8443

DESIGN OF REACTORS AND CLOSURES. Fred Gasche (Autoclave Engineers, Inc., Erie, Penna.). Ind. Eng. Chem. 48, 838-40(1956) May.

A study was made of design and fabrication of equipment for service at elevated pressures and temperatures. (J.E.D.)

8444

SELECTION OF ALLOYS FOR SERVICE REQUIREMENTS. James W. Freeman and Howard R. Voorhees (Univ. of Michigan, Ann Arbor). Ind. Eng. Chem. 48, 861-71(1956) May.

Principles of using available data to select alloys for vessels for extreme pressure at elevated temperature have been reviewed. When the service stresses and temperatures are accurately known, together with properties of the specific lot of alloy used, performance of the alloy should be in accord with predictions within practical engineering limits. Some of the properties which may be used to provide safeguards against some unknown stress conditions are dismissed. A short listing of alloy properties is given to indicate typical properties of some of the newer alloys with high strength at high temperatures. Metallurgical variables are always present and require a more thorough study for each application. Direct consultation with the alloy supplier is suggested before a new alloy is selected for use at conditions where no prior experience exists. (auth)

8445

THICK-WALLED PRESSURE VESSELS. H. R. Voorhees, C. M. Sliepcevich, and J. W. Freeman (Univ. of Michigan, Ann Arbor). Ind. Eng. Chem. 48, 872-81(1956) May.

Changes in stress distribution in thick-walled pressure vessels under internal pressure at elevated temperatures are analyzed, and a procedure is developed for calculating the time of rupture from creep and stress rupture data. (auth)

8446

EFFECTS OF HYDROGEN ON PROPERTIES OF METALS. D. D. Perlmutter and B. F. Dodge (Yale Univ., New Haven, Conn.). Ind. Eng. Chem. 48, 885-93(1956) May.

A study was made of the effect on metals exposed to H gas atmospheres at pressures between 7500 and 60,000 psi at room temperature and to pressures of 15,000 and 30,000 psi temperatures up to 500°C. The time of exposure was varied between 6 hrs and 60 days so that information would be available as to the rate of the embrittlement process. (J.E.D.)

8447

VAPOUR LUBRICATION OF TITANIUM AND ZIRCONIUM. G. W. Rowe (Tube Investments Research Labs., Cambridge, England). Brit. J. Appl. Phys. 7, 152-3(1956) Apr.

The coefficient of friction of Ti and Zr sliders in a vacuum is ~2.0. The admission of I permits the formation of dihalide films which reduce μ to ~0.3. (D.E.B.)

8448

PREPARATION OF METALLIC Pu IN GRAM QUANTITIES. Francois Anselin, Pierre Faugeras, and Emmanuel Grison. Compt. rend. 242, 1996-8(1956) Apr. 16. (In French)

The preparation of the trifluoride of Pu and the fabrication of the metal by calciothermic reduction of the trifluoride are described. (B.J.H.)

8449

ON THE APPLICATION OF THE THOMAS-FERMI-DIRAC METHOD TO THE STUDY OF THE RESIDUAL RESISTANCE OF BINARY ALLOYS CONTAINING FOREIGN ATOMS IN SMALL CONCENTRATIONS. Hiroshi Fujiwara (Univ. of Tokyo). J. Phys. Soc. Japan 11, 376-82(1956) Apr.

By taking the exchange interaction among electrons, which was neglected in previous work, into account, the modified screened potential around the substitutional impurities of di- or trivalent metal in monovalent metal in dilute solid solution is exactly obtained from the Thomas-Fermi-Dirac type equation by numerical integration. As one of the applications of this potential, the residual resistance due to the foreign atoms was considered. The method of partial waves together with the Born approximation was used for the calculation of the scattering cross section and the residual resistance was calculated. The agreement of theoretical values with experiment has been greatly improved by introducing the exchange effects. (auth)

8450

ELECTRON-DIFFRACTION STUDY OF THE STRUCTURE OF SUPERCOOLED LIQUID BISMUTH. Mieko Takagi (Tokyo Inst. of Tech.). J. Phys. Soc. Japan 11, 396-405 (1956) Apr.

Thin Bi films were prepared on crystal surfaces by evaporation, and the liquid state of the films at temperatures above and below the ordinary melting point (271°C) has been studied by means of the reflection method of electron diffraction. The marked supercooling of the films (M. Takagi: J. Phys. Soc. Japan 9, 359(1954)) has been utilized for the study below the melting point. A method to eliminate difficulties inherent to the intensity measurement by reflection method and a method to refine the observed intensity values were developed. The radial distribution curves at 400°C, 271°C (the melting point), 175°C, 130°C and 110°C (a little

above the solidification temperature) were computed from experimental data. The curves showed a systematic change with temperature. It was revealed that the atomic arrangement at 110°C resembles closely that of solid bismuth. Above the melting point a tendency towards close-packed structure was noted. (auth)

8451

APPLICATION OF THE METHOD OF IONIC SCOURING IN ELECTRON DIFFUSION: STUDY OF THE STRUCTURE OF THERMAL DEPOSITS OF GOLD ON CRYSTALLINE OR AMORPHOUS SUPPORTS. Jean Jacques Trillat, Nobuzo Terao, Lea Tertian, and Henri Gervais. J. Phys. Soc. Japan 11, 406-12(1956) Apr. (In French)

A new arrangement was made which allows simultaneous bombardment of a sample with ions and examination of its structure. In these conditions a progressive scouring of the superficial coats is obtained; electron diffraction gives information about the structure. The experimental method is described and an example referring to the study of the gold coats laid down on different props is given. It is thus possible to study continuously the relations of epitaxy between the prop and the metal laid down in various conditions. The limits of that method and the causes of error are discussed. (auth)

8452

HIGH PRESSURE OXIDATION OF METALS—TUNGSTEN IN OXYGEN. J. P. Baur, D. W. Bridges, and W. M. Fassell, Jr. (Univ. of Utah, Salt Lake City). J. Electrochem. Soc. 103, 266-72(1956) May.

Tungsten rod and sheet were found to oxidize linearly in oxygen from 600 to 850°C at oxygen pressures ranging from 20 to 500 psia. Oxidation rate increased with increased oxygen pressure at temperatures 750 to 850°C. Theoretical considerations indicate that an equilibrium adsorption process occurs prior to the rate-determining step. The assumption of a linear change of adsorption energy with increase of surface coverage allowed observed oxidation rates to be correct for pressure effect. The activation energy was 48 kcal. Tungsten sheet volatilization losses were appreciable above 800°C. Only tungsten rod data were free from volatilization losses at 850°C. Photographs are included showing the effect of shearing samples at room temperature prior to oxidation on the final physical appearance of the oxide. Cold shearing produces exfoliated tungsten oxide. (auth)

8453

DETERMINATION OF THE ACTIVITY OF SODIUM IN SODIUM – LEAD ALLOYS AT HIGH TEMPERATURES. Bernard Porter and Morris Feinlieb (Kaiser Aluminum and Chemical Corp., Permanente, Calif.). J. Electrochem. Soc. 103, 300-3(1956) May.

The activity of sodium in sodium–lead alloys was determined by the concentration cell method. The emf of cells Na (pure)/Na^+/Na in Pb was directly measured up to 820°C, using alumina containers impregnated with Na_2CO_3 in an argon atmosphere. Results were converted to activities and extrapolated to 1010°C. To check the extrapolation, emf's of cells of the type Na(α_1) in Pb/Na^+/Na(α_2) in Pb were measured up to 1010°C The α_2/α_1 ratios calculated from the measurements were compared with those obtained by extrapolation. Fair agreement was found. (auth)

8454

STUDIES ON THE NITRIDING OF TITANIUM. Shun-ichi Satoh and Koshin Yamane. J. Sci. Research Inst. (Tokyo) 49, 325-30(1955) Dec.

A new method of treating titanium by ammonia has recently been introduced into metallurgical industry, by means of which various titanium products can be made more resistant to wear and corrosion. It can produce a hard layer like nitrided nitralloy. Titanium nitride is a compound that conducts more electricity than metallic titanium. It shows a thermoelectric effect like ordinary metals and alloys. Single potential difference of nitrided titanium in various solutions was measured with the object of studying the corrosion problem. It revealed that titanium becomes nobler when nitrided and has a great resistance to corrosion. Hardness tests, microscopic examination, and electron-diffraction analysis were also made. (auth)

8455

INORGANIC GRINDING FLUIDS FOR TITANIUM ALLOYS. M. C. Shaw and C. T. Yang. Trans. Am. Soc. Mech. Engrs. 78, 861-8(1956) May.

Dilute aqueous solutions of certain inorganic salts are very effective in decreasing the rate of grinding-wheel wear and providing decreased surface roughness in the finishing of titanium-alloy surfaces. A systematic study of a large number of salt solutions has revealed that such solutions act by the formation of adsorbed cationic and anionic layers on the aluminum-oxide and titanium surfaces, respectively. These layers prevent the abrasive and chip surfaces from coming close enough together to form strong bonds, which when broken, remove pieces of abrasive from the system. In the choice of a suitable material, ion size and effective charge are found to be two items of major importance. Barium was found to be the most effective element in the periodic table for adsorption on aluminum oxide, while the phosphate radical was the most effective anion investigated for adsorption on a titanium alloy surface. Long chains attached to each of these ions should increase the effectiveness of the simpler ions considered here. The relation between corrosion inhibition and the screening of titanium surfaces in grinding is discussed. (auth)

8456

"SPIRAL POLYGON" TIN WHISKERS. Paul W. Levy and Otto F. Kammerer (Brookhaven National Lab., Upton, N. Y.). J. Appl. Phys. 26, 1182-3(1955) Sept.

Tin whiskers that form spiral polygons were grown rapidly from the edges of a stack of tin plate compressed in a clamp. Growth and bends take place at the base. Mechanical twinning seems to be the growth mechanism. (F.S.)

PHYSICS

8457 AERE-M/R-1898

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE MEASUREMENT OF VAPOUR PRESSURES BY A MODIFIED DEW-POINT METHOD WITH PARTICULAR REFERENCE TO THE SYSTEM MERCURY–MAGNESIUM. B. R. T. Frost and J. T. Maskrey. 1956. 23p.

A number of thermodynamic functions of the components of a binary alloy system can be derived from the measurement of the vapor pressure of the more volatile component. Three different methods of measurement of vapor pressure were examined before the dew-point method was selected as giving the most accurate results and being the simplest to operate. The dew point was detected by the reaction of a photoelectric cell to a beam of light passing through a glass chamber containing the metal vapor. The apparatus was used to determine the vapor pressure of Hg over Hg–Mg alloys and over ternary Hg–Mg–Pb alloys. Thermodynamic activities and partial molar functions were calculated from the vapor pressure data. (auth)

8458 NACA-TN-3273

National Bureau of Standards, Washington, D. C.

COMPRESSIBILITY FACTOR, DENSITY, SPECIFIC HEAT, ENTHALPY, ENTROPY, FREE-ENERGY FUNCTION,

VISCOSITY, AND THERMAL CONDUCTIVITY OF STEAM. Lilla Fano, John H. Hubbell, and Charles W. Beckett. Aug. 1956. 61p.

The NBS-NACA tables of thermal properties of steam are grouped together for convenient use. They include the compressibility factor, density, specific heat at constant pressure, enthalpy, entropy, free-energy function, viscosity, and thermal conductivity for the real gas and the specific heat, enthalpy, entropy, and free-energy function for the ideal gas. Conversion factors to frequently used units are given to facilitate use of the tables in dimensionless form. (auth)

8459 NOLC-268

Naval Ordnance Lab., Corona, Calif.

COMPUTING MACHINE COMPONENTS PROGRAM QUARTERLY REPORT NO. 9 [FOR] JULY–SEPTEMBER 1954. Sept. 1955. 56p.

Techniques for increasing the reproducibility of evaporated magnetic cores by better control of their composition and thickness were introduced. Determination of the vacuum distillation curves of Fe–Ni and Fe–Co alloys was completed. A method of observing the magnetization reversal signal of a thin sheet of ferromagnetic material was found, making it possible to obtain a switching signal with a 20 to 1 signal-to-noise ratio from as little as 50 μgm of magnetic alloys. Descriptions are given of the electrical behavior in the orthorhombic and rhombohedral phases of $BeTiO_3$ crystal plates. A study was also made of the effect of a change in duty factor on the information-handling rate of a system. Delay line studies were continued. A circuit diagram is given for a 40-Mc pulse burst generator. Ferromagnetic resonance experiments are briefly described. (For preceding period see NOLC-252.) (B.J.H.)

8460 NOLC-290

Naval Ordnance Lab., Corona, Calif.

COMPUTING MACHINE COMPONENTS PROGRAM QUARTERLY REPORT NO. 10 [FOR] OCTOBER–DECEMBER 1954. Jan. 13, 1956. 38p. (NAVORD-4557)

The pulse applications of thin magnetic films were studied including the effects of film thickness, optimum geometry of drive and pickup loops, and effects of relative spacing. Experimental procedures are described for the study of the cross-coil effect of Permalloy ribbon. An investigation was also made of the sharp increase in reverse current at large reverse voltages in silicon junction diodes. The applications of this phenomenon to diode capacitor memory were also studied. Experimental relations between the coercivity of a c-domain area and the ferroelectric crystal phases of $BaTiO_3$ are included. Studies of the ferromagnetic resonance effect in thin films were continued. (For preceding period see NOLC-268.) (B.J.H.)

8461 NP-5915

New York Univ., New York.

FLUORESCENCE AND CONDUCTIVITY PHENOMENA. Quarterly Progress Report No. 2 for May, June, July 1955. Physics Dept. Hartmut Kallmann. Apr. 1956. 57p. Contract DA-36-039-sc-64526.

The fluorescence of a large member of organic compounds was investigated under different conditions using Ra gamma and light excitation. The relative efficiencies under both types of radiation are tabulated for solutions and solids. The effects of structure and gaseous impurities are discussed. Methods of making liquid solutions which have considerable fluorescence under high-energy radiation and which contain compounds of heavy elements are described. (For preceding period see NP-5786.) (D.E.B.)

8462 NP-5946

New York Univ., New York.

FLUORESCENCE AND CONDUCTIVITY PHENOMENA. Quarterly Progress Report No. 3 for August, September, October 1955. Physics Dept. Hartmut Kallmann. Apr. 1956. 73p. Contract DA-36-039 sc-64526.

The process of light stimulation in ZnCdS phosphors is discussed. Experiments performed to indicate the reliability of present theory are reviewed. The photoconductivity of a number of ZnCdS phosphors has been measured. The data for two of these are plotted. (For preceding period see NP-5945.) (D.E.B.)

8463 NP-5948

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 18. Oct. 15, 1955. 60p. Contract N5ori-07856.

An approximate solution of Hartree-Fock equations by matrix methods is discussed in detail. A program has been constructed to evaluate nuclear attraction integrals. Methods which have been developed for calculations concerning doubly excited states of the H molecule are briefly discussed. Brief consideration is also given to calculations on the lithium hydride molecule. Theoretical work on polarization effects in the F ion is summarized. Formulation was made of a multiplicative correction to improve approximate wave functions for many-electron systems which explicitly introduces interelectron distances. The correction is to be applied only where two electrons are within a certain finite range of each other, and is known as the "Coulomb hole." The electronic structure of the V center in KCl was studied. An augmented plane wave method as applied to Na is described. A calculation has been performed for the phonon-polaron differential scattering cross section with Feynman's description of the polaron as a starting point. Procedures for calculating the mass of the polaron are described in detail. (For preceding period see NP-5726.) (B.J.H.)

8464 NP-5949

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 19. Jan. 15, 1956. 69p. Contract N5ori-07856.

The superexchange mechanism in antiferromagnetic oxides is discussed, and some results are tabulated for MnO, FeO, CoO, and NiO. Preliminary data are discussed on the ground electronic state, the excited electronic states, and the s,p-hybridization in the lithium hydride molecule. The electronic energy of the OH molecule was calculated by the "Configuration Interaction" method, and some results are tabulated. A program for the determination of polarization effects in the F ion is briefly outlined. The calculation of energy bands in graphite was continued. The expansion of radial functions about non-central points is discussed in connection with molecular calculations. The Coulomb hole correction was applied to the 2-electron system. Work was continued on the electronic structure of the V center in KCl. The augmented plane wave method as applied to the structure of Na is discussed. Calculations were made of the effective mass of the polaron. The small oscillation theory of the polaron is discussed in detail. (For preceding period see NP-5948.) (B.J.H.)

8465 NP-6032

New York Univ., New York.

FLUORESCENCE AND CONDUCTIVITY PHENOMENA. Quarterly Progress Report No. 4 for November, December 1955, January 1956. Physics Dept. Hartmut Kallmann. May 1956. 49p. Project No. 196B. Contract DA-36-039-sc-64526.

In previous studies of pyrene fluorescence in mixtures of xylene and paraffin oil, a considerably higher fluorescence from γ and uv excitation was obtained with large amounts of paraffin oil than with xylene alone. Experiments were conducted to further explore the influence on fluorescence of various solvents under γ and uv excitation. A method is described for determining the ratio of radiative to nonradiative transitions in phosphor decay. This method employs a comparison of the deficiency areas in the fluorescent rise and decay curves. Curves were plotted which show the effects of excitation energy and trap population distribution on the shape of stimulation curves. Possible explanations for these effects are advanced. (For preceding period see NP-5946.) (D.E.B.)

8466 NP-6042
Naval Research Lab., Washington, D. C.
NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period April–June 1956. July 1, 1956. 61p.

Coulomb excitation in V, Ni, Ga, and Rb was studied in an attempt to observe the presence of rotational effects in the decay of these nuclei. The results of this study are reported. Differential cross sections for the reaction $Be^{9}(He^{3}, p)B^{11}$ were measured at 2 Mev. This reaction, considered a test of the type of process involved, indicates contributions from both compound nucleus and direct processes. Classification of the unitary irreducible representations of the universal covering group of the 3 + 2 deSitter group is discussed. Theoretical considerations of the mass spectrum of spin-$\frac{1}{2}$ particles and nuclear cross sections at high energies are presented. Inelastic scattering of 2.6-Mev neutrons in Fe and W was studied, using the He^{3} coincidence technique with the scintillation-summing spectrometer. Spectra are given, and the spectrometer efficiency is discussed. Equations are developed which indicate the conditions for stability in a completely ionized plasma. A detailed calculation of the amplitude increase arising from lens strength distribution in the synchrotron is shown. The design of an external electron injector for the NRL synchrotron is discussed. The goal of the design is to capture 10^{12} electrons per burst. Nucleate boiling studies were continued with an analysis of bubble formation on Nichrome wire and stainless steel strips. The conditions of the experiments were such that the energy pulse was constant while the ambient water temperature was varied. The results are pictorially and graphically presented. In support of these studies, calculations of the temperature distribution around a small wire were carried out. (For preceding period see NP-5947.) (D.E.B.)

8467 NP-6054
Amherst Coll., Mass.
FINAL REPORT [FOR] SEPTEMBER 10, 1948–DECEMBER 31, 1955. Theodore Soller. 20p. Contract N8onr-66901.

A brief summary is given of the work done on the separation of He^{3} from ordinary He by the "heat-flush" method, the construction of a mass spectrometer to analyze the results of the separation, and the development of techniques for the investigation of the properties of substances below 0.1°K. Complete descriptions and diagrams of the Nier-type mass spectrometer are included. Complete descriptions are also given of the cryogenic equipment. (B.J.H.)

8468 OSR-TN-56-114
Technion Research and Development Foundation Ltd., Haifa, Israel.
RESEARCH ON THE PHYSICS OF AIR VISCOSITY. Summary of Research Progress for the Period of July 15, 1955 to January 15, 1956. Markus Reiner. 97p. Contract AF 61(514)-871. (AD-82510)

The Weissenberg effect is described and its possible mechanisms analyzed. An elastico-viscometer that determines the Weissenberg effect and the viscosity of small samples was designed. Experiments performed with a centripetal air-pump confirmed that the effect found in very viscous liquids is present in air. (F.S.)

8469 UCRL-3410
California. Univ., Berkeley. Radiation Lab.
PHYSICS DIVISION QUARTERLY REPORT [FOR] FEBRUARY, MARCH, APRIL 1956. May 22, 1956. 38p. Contract W-7405-eng-48. $0.30(OTS).

Development studies are reported on liquid H bubble chambers, K^{-} beam extraction in the Bevatron, Bevatron beam structure, and cyclotron probes. Bevatron, cyclotron, linear accelerator, and synchrotron operations are reviewed. A brief description and the status of the various problems being investigated by the theoretical group are given. Transmission measurements of nucleon and nuclear cross sections were made using 4.3 Bev/c π^{-} mesons. Total and absorption cross sections are given for Be, C, Al, and Cu. Fifteen stars were found in a nuclear emulsion study of antiprotons. Five of the annihilations occurred at rest, ten in flight. A table is given showing the results of an analysis of these stars. (For preceding period see UCRL-3326.) (D.E.B.)

8470 WADC-TR-53-133(Pt. 2)
Plax Corp., Hartford, Conn.
THEORETICAL INVESTIGATION OF THE MECHANISM OF TRANSFER OF MATERIALS THROUGH POLYETHYLENE. Covers Work Conducted from April 1952 to June 1954. Henry A. Bent and Jules Pinsky. Aug. 1955. 90p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: PACKAGING MATERIALS. Contract AF33(616)-112.

The effect of temperature on the permeability P has been found to be accurately represented by the two-parameter equation $P = P_o e^{-Ep/RT}$ in which Ep and P_o are constants for the particular permeant polymer system. These parameters are calculated from carefully constructed log Prs. 1/T plots. The size, shape, and polarity of the penetrant molecule are factors influencing E_p and for substances no more polar than acetone the expression $E_p = 0.0348V + 0.75 V/L + 2.4 \Delta\Delta H$ reproduces the data to within about 0.5 kcal/mol where polyethylene is the permeable film. It is established that for four homologous series that log P_o = mEp + b where m and b are constants peculiar to each series. Master plots for interpolating homologous materials and extrapolating for temperature changes are included. (auth)

8471 WADC-TR-53-201(Pt. 6)
National Bureau of Standards, Washington.
THERMAL CONDUCTIVITY AND HEAT CAPACITY OF MOLTEN MATERIALS. PART 6. THE THERMAL CONDUCTIVITY OF BERYLLIUM OXIDE FROM 40° TO 750°C. Period Covered: January 1955 to June 1955. D. A. Ditmars and D. C. Ginnings. Oct. 1955. 22p. Project No. 1252. Task No. 73013. Contract AF (33-616) 52-10.

The thermal conductivity of BeO has been measured from 40 to 750°C with an apparatus employing steady-state longitudinal heat flow along a rod of high-fired BeO surrounded by a "guard" tube with matching temperature gradient to minimize radial heat loss. The estimated accuracy of the measurements is about 2%. However, the values of thermal conductivity of the ideal BeO crystal are probably somewhat higher than the values given because of the low density (2.62 g/cm^{3}) of the sample used. (auth)

8472 AEC-tr-2517
THE VENTURI-FLUME AS A METER FOR SEWAGE FLOW. Teikiti Kitazawa. Translated from J. Civ. Engng. Soc., Japan. (Doboku-Gakkai-Si) 25, 219-25(1939). 16p.

The characteristics of the venturi-flume as a meter for sewage flow is discussed. The theoretical flow equation in a cylindrical duct is derived and the method of determining the potential head is described. (auth)

8473 AEC-tr-2524
THE LIFESPAN OF PARTICLES IN THEIR ADSORBED STATE. (Die Lebensdauer von Teilahen im adsorbierten Zustande). D. Blochinzew and Sch. Schechter. Translated from Acta Physicochim. U.R.S.S. 3, 767-78(1935). 13p.

The life span of particles in their adsorbed state is calculated on the basis of the perturbation theory of quantum mechanics. The resultant life span formula is valid under the condition that the mass of the adsorbed particles is considerably smaller than the mass of the particles of the adsorbent. Finally the initial energy of an adsorbed particle is evaluated. (auth)

8474
TRANSLATIONAL MOTION OF A SPHERE IN A MAGNETIC FIELD. Herbert B. Rosenstock and Talbot A. Chubb (Naval Research Lab., Washington, D. C.). Am. J. Phys. 24, 413 (1956) May.

The possible effects of a uniform magnetic field on the translational motion of an uncharged conducting sphere are discussed in connection with the proposed launching of a metallic satellite moving in the earth's equatorial plane. It is concluded that, for non-relativistic velocities, any effects are negligible. (B.J.H.)

8475
STRUCTURE OF A MAGNETOHYDRODYNAMIC SHOCK WAVE IN A PLASMA OF INFINITE CONDUCTIVITY. Hari K. Sen (National Bureau of Standards, Boulder, Colo.). Phys. Rev. 102, 5-11(1956) Apr. 1.

The structure of a magnetohydrodynamic perpendicular shock wave (magnetic field perpendicular to the direction of propagation) in a plasma of infinite conductivity has been analyzed. For the nonmagnetic case, the width of the shock front is found to be larger than in a non-ionized gas. Further, the width of the shock (in terms of mean free path within the shock) as a function of the shock strength as determined from the Stokes-Navier equations (which applies to weak shocks) is found to join smoothly at $M \simeq 1.3$ with the same function as derived from the Mott-Smith analysis (which applies to strong shocks). The magnetic field tends to make the shock front narrower for shocks of moderate strength. It does not have appreciable effect for strong shocks. Application of the above results to solar radio noise and current theories of the origin of cosmic rays is indicated. (auth)

8476
NONLINEAR FIELD THEORY. Karl Bechert. Z. Naturforsch. 11a, 177-82(1956) Mar. (In German)

8477
APPARATUS FOR THE DIRECT DETERMINATION OF THE DYNAMIC BULK MODULUS. John E. McKinney, Seymour Edelman, and Robert S. Marvin (National Bureau of Standards, Washington). J. Appl. Phys. 27, 425-30(1956) May.

An apparatus has been developed for the direct measurement of the real and imaginary parts of the dynamic bulk modulus of solid and liquid materials over the frequency range of 50 to 10,000 cps. Piezoelectric crystals serving as driver and detector, together with the sample and a confining liquid, are contained in a cavity small compared with the wavelength of sound at these frequencies. Static pressure is superposed to eliminate the effect of small air bubbles. The complex compliances of the sample, confining liquid, and the cavity, are additive in this region, where the compliance is pure dilatation. The dynamic compliances of several natural rubber-sulfur mixtures were obtained in a preliminary evaluation of the behavior of the apparatus. (auth)

8478
PROBLEM OF INTENSE SURFACE HEATING OF A SLAB ACCOMPANIED BY CHANGE OF PHASE. Joseph I. Masters (Technical Operations, Inc., Arlington, Mass.). J. Appl. Phys. 27, 477-84(1956) May.

In an attempt to bound the problem, steady-state solutions are obtained for the speed of surface recession (melting) and the internal temperature history of a slab which uniformly absorbs heat on one face at a large caloric rate. The solutions are found to be sensitive to assumptions that must be made regarding both the thickness attained by the layer of molten matter produced during the heat pulse and the mechanisms (e.g., air drag, evaporation) that control this thickness. (auth)

8479
PRODUCTION AND USE OF HIGH TRANSIENT MAGNETIC FIELDS. I. H. P. Furth and R. W. Waniek (Harvard Univ., Cambridge, Mass.). Rev. Sci. Instr. 27, 195-203(1956) Apr.

Experiments involving pulsed magnetic fields of a half-megagauss and more are shown to be practical. Some basic concepts are developed regarding the construction of impact resistant solenoids and the selection of the appropriate power supply. Operation of various high-field magnets in the pulse range 50 to 10,000 μsec is discussed, and some techniques for associated solid state experiments are given. Magnetoresistance measurements up to 600,000 gauss have been made for germanium. Operation of a 175,000 gauss Helmholtz-type magnet for nuclear track plate work with the 95-Mev Harvard synchrocyclotron is described. (auth)

8480
USE OF NICKEL DIFFUSION TUBES FOR THE PURIFICATION OF HYDROGEN. L. C. W. Hobbis and E. R. Harrison (Atomic Energy Research Establishment, Harwell, Berks, England). Rev. Sci. Instr. 27, 238(1956) Apr.

The relative merits of Ni and Pd as materials for the purification of H_2 by diffusion are briefly discussed. (B.J.H.)

COSMIC RADIATION

8481 AERE-Lib/Trans-580
THE SPATIAL DISTRIBUTION OF NUCLEAR-ACTIVE PARTICLES IN WIDE ATMOSPHERIC SHOWERS OF COSMIC RAYS. Yu. N. Vavilov, S. I. Nikol'skii, and V. P. Sarantsev. Translated by V. Beak from Zhur. Eksptl'. i Teoret. Fiz. 28, 505-6(1955). 2p.

The flux of nuclear-active particles in wide atmospheric showers at 3860 m was determined from the number of electron-nuclear showers caused in lead by the shower particles. Resultant data are shown in graphical form. (B.J.H.)

8482 AERE-Lib/Trans-597
ON LIMITING EXTENSIVE ATMOSPHERIC SHOWERS OF COSMIC RADIATION. D. V. Skobel'tsyn. Translated by J. B. Sykes from Doklady Akad. Nauk S.S.S.R. 67, 45-8 (1949). 6p.

The interpretation of coincidence events recorded in counters up to 1000 m apart is briefly discussed. (See also AERE-Lib/Trans-598.) (B.J.H.)

8483 AERE-Lib/Trans-598
ON THE COURSE OF THE "CORRELATION CURVE" FOR AUGER SHOWERS AT LARGE DISTANCES. D. V. Skobel'tsyn. Translated by J. B. Sykes from Doklady Akad. Nauk S.S.S.R. 67, 255-8(1949). 4p.

The problems of interpreting coincidences recorded in two groups of counters up to 1000 m apart are briefly dis-

cussed. (See also AERE-Lib/Trans-597.) The difficulties in attributing these coincidences to normal Auger showers are shown. (B.J.H.)

8484

ANGULAR CORRELATIONS IN V^0 TYPE DECAYS. M. Deutschmann (Max-Planck-Institut fur Physik, Gottingen) and M. Cresti, W. D. B. Greening, L. Guerriero, A. Loria, and G. Zago (Istituto di Fisica dell' Universita, Padova). Nuovo cimento (10) 3, 566-73(1956) Mar.

Measurements have been made on 34 V^0 events produced by cosmic ray particles in the lead plates of a cloud chamber, and the angular correlation between the production and decay planes has been studied. If one limits the analysis to the V^0 particles produced in interactions in which only a small number, N_h, of heavily ionizing particles is seen to be emitted, a correlation is found in favor of small angles, whereas for large N_h the correlation appears to vanish. (auth)

8485

THE <<N>> COMPONENT OF COSMIC RAYS IN RELATION TO OSCILLATIONS OF THE ATMOSPHERE. P. Bassi and F. Ferrari (Istituto di Fisica dell'Universita, Padova). Nuovo cimento (10) 3, 806-14(1956) Apr.

Acting on the suggestion implicit in some recent experimental results, Heisenberg's theory was used to calculate the correlation between oscillations of the earth's atmosphere and the intensity of the N component of cosmic rays. The theoretical predictions are in qualitative but not in quantitative agreement with the experimental results. However it may be noted that these latter are, at present, statistically poor. (auth)

8486

MEASUREMENTS ON HIGH ENERGY ELECTRON SHOWERS. E. Lohrmann (Physikalisches Institut der Universitat Bern and Hochspannungslaboratorium Hechingen). Nuovo cimento (10) 3, 820-1(1956) Apr.

Electron-positron pairs produced in a high-energy nuclear event are analyzed briefly. (B.J.H.)

8487

MESON PRODUCTION AT VERY HIGH ENERGIES. E. Lohrmann (Physikalisches Institut der Universitat Bern and Hochspannungslaboratorium Hechigen). Nuovo cimento (10) 3, 822-4(1956) Apr.

The production of mesons in stripped emulsions exposed at an altitude of 29 km is discussed. Angular distributions of the mesons are shown. (B.J.H.)

8488

EXCEPTIONAL PERTURBATION OF SOLAR RADIATION ON FEBRUARY 23, 1956. Robert Bureau and Maurice Bertrand. Compt. rend. 242, 2025-7(1956) Apr. 16. (In French)

A description is given of the phenomena occurring in the records of the mean atmospheric field and other connected phenomena on Feb. 23, 1956. (tr-auth)

8489

GENERATION OF THE SOFT COMPONENT OF THE COSMIC RADIATION IN LEAD. P. H. Stoker (Potchefstroom Univ., South Africa). Phys. Rev. 102, 516(1956) Apr. 15.

The Rossi transition curve as obtained for the soft component of the cosmic radiation in the atmosphere, is compared with the curves obtained with a 10-cm absorbing lead layer just above and 86 cm above a counter arrangement. The stronger maximum of the curve obtained with the lead layer in the higher position may be attributed to unstable neutral particles emerging from the lead layer. (auth)

8490

ON SPECTRA OF PRIMARY PROTONS. Ya. P. Terletskiĭ (Lamonosov Moscow State Univ.) Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 17-21(1956) Jan. (In Russian)

It is known that cosmic rays are protons and ions of heavy elements expelled by a primary source (a star) into the interstellar space and additionally charged by diffusion into the magnetized interstellar media in turbulent motion. The type of stars which form the primary source or the ultimate properties or characteristic process of the motion in the interstellar media have not been established. However, it is known that energy spectra of particles in the primary components are affected by the process of particle diffusion into the magnetized, ionized media which is in a state of turbulent motion. Calculations based on a diffusion-type equation are presented. Collisions between protons accelerated by interstellar fields and stationary protons in the interstellar gas are discussed. Corrections are offered for previous calculations and in the Fermi assumption that in collision the accelerated proton loses its energy and the stationary one does not acquire enough energy to be accelerated by the interstellar fields, consequently, collision results in the loss of fast protons. Corrections show that in a collision of ultrarelativistic protons with stationary protons, either both protons acquire relativistic energies (when the collision is close to non-elastic) or one of the protons retains the ultrarelativistic energy (when the collision is close to an elastic one). In both cases either both or one of the collision protons can be accelerated by the interstellar field. (R.V.J.)

8491

DIFFUSION AND ACCELERATION OF CHARGED PARTICLES IN MAGNETIZED INTERSTELLAR MEDIA. A. A. Logunov and Ya. P. Terletskiĭ (Lomonosov Moscow State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 22-3(1956) Jan. (In Russian)

The diffusion of charged particles into magnetized interstellar media is studied with the purpose of determining the properties of primary cosmic radiation. The emitted particles pass through magnetized interstellar media and undergo a series of changes. The mechanism of the particle passage through the interstellar magnetized media is similar to the process of diffusion of particles into gases. The relation of the diffusion coefficient to the particle energies is analyzed. A detailed study of small and large energies of particles confirmed the Fermi theory about the charged particles acceleration by the magnetized media in motion. (R.V.J.)

8492

THE PRODUCTION OF CHLORINE-39 IN THE LOWER ATMOSPHERE BY COSMIC RADIATION. Lester Winsberg (Weizmann Inst. of Science, Rehovoth, Israel). Geochim. et Cosmochim. Acta 9, 183-9(1956) Apr.

Examination of rain-water has revealed the presence of Cl^{39} formed by the interaction of cosmic radiation with A in the lower atmosphere. The maximum amount of activity found agrees with what is expected from known reactions of cosmic radiation. Most of the production of Cl^{39} is due to the reaction $A^{40} + \mu^- = Cl^{39} + n + \nu$. In several cases little activity was found. This appears to result from meteorological phenomena. Cl^{39} is potentially useful in meteorology with specific application to the study of rain. (auth)

8493

PRODUCTION OF COSMIC RAY MESONS AT LARGE ZENITH ANGLES. D. Jakeman (National Research Council, Ottawa, Canada). Can. J. Phys. 34, 432-50(1956) May.

Events have been selected by coincidences between separated shielded trays of Geiger counters and it is shown that they arise from three types of phenomena, namely, extensive air showers, casual coincidences, and particles travelling in almost a horizontal direction. Selection of the last type of event has enabled the absolute intensity to be determined at zenith angles between 88° and 90°. Using a π meson produc-

tion spectrum which gives consistency with the established underground absorption curve the intensity of particles in the horizontal direction has been calculated on the assumption that $\pi-\mu$ decay is the only source of μ mesons. The calculated intensity agrees well with the observations. Alternatively, by comparing the rate in the horizontal direction with the known rate underground, a value of $4.5 \pm 1.5 \times 10^{-8}$ sec. is obtained for the lifetime of the parents of μ mesons which, because of the depth of the atmosphere in the horizontal direction (362 m.w.e.), must have energy exceeding 10^{11} ev. This suggests that at this energy the parents of μ mesons can be identified with the π meson, and the number of μ mesons arising from the decay of a shorter lived meson (e.g. K meson) must be relatively small. (auth)

8494

ON PION-PAIR PRODUCTION IN NUCLEAR EMULSIONS. Erwin M. Friedländer (Hungarian Academy of Sciences, Budapest). Nuclear Phys. 1, 363-5(1956) Apr.

Descriptions are given of an event found in an Ilford G-5 emulsion exposed at 2867 m which is interpreted as a possible pion-pair production. (B.J.H.)

8495

COSMIC-RAY RECORDS OF THE SCIENTIFIC RESEARCH INSTITUTE. II. Yukio Miyazaki. J. Sci. Research Inst. (Tokyo) 49, 267-84(1955) Dec.

Unbroken recording of cosmic-ray intensity is being continued with almost the same layout of the apparatus as described in the previous report. The intensity obtained in 1951 and 1954 are tabulated together with the graphical representation of their monthly average intensity, daily variation, and 27-day recurrence tendency. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

8496 AERE-Lib/Trans-630

CLASSICAL NON-LINEAR LATTICE STATICS OF DISTORTED CRYSTAL STRUCTURES. E. Fues and H. Stumpf. Translated by F. Hudswell from Z. Naturforsch. 10A, 136-45(1955). 20p.

A method is developed, using the classical mechanical point-model, for the determination of the equilibrium states of lattices which are disturbed by atoms in interstitial lattice positions, dislocations, etc. The binding forces which occur in the disturbed positions, and which deviate from those of the remaining lattice environment, are of interest in connection with the dynamics of the lattice. A simple example, in which one atom is stored at an interstitial lattice position in the closest packing of spheres, shows that for physically significant particle potentials the restoring forces which occur at the disturbed atom through oscillation increase to 40 to 50 times the value in the undisturbed lattice environment. The equilibrium configuration, and its dependence on the chosen potential, is described. (auth)

8497

ADSORPTION AND SURFACE POTENTIAL OF SEMICONDUCTORS. PART II. Akio Kobayashi and Shinji Kawaji (Hokkaido Univ., Sapporo, Japan). J. Phys. Soc. Japan 11, 369-75(1956) Apr.

The surface potential and its change with illumination for the (110) cleavage surface of zincblende have been measured. It was found that electron trap centers were created near the surface of the crystal, when the crystal was heat-treated in vacuum, and these traps were diminished by the reaction with oxygen. The traps are attributed to sulphur vacancies which are formed by evaporation of sulphur component by the following reasons; (1) the higher the temperature of heat treatment in vacuum, the larger the number of traps becomes and (2) after heat treatment at 350°C for 4 hours in vacuum, the surface becomes charged positively. It is concluded that oxygen reacts with these traps charging the surface negatively. An overall change of surface potential in the range between the initial and saturated adsorption agrees fairly well with the initial heat of adsorption observed, as expected theoretically. (auth)

8498

ON THE ABSORPTION OF LIGHT BY COLOUR-CENTRES IN THE REGION BETWEEN F-BAND AND M-BAND. Hisao Yagi (Univ. of Kyoto, Japan). J. Phys. Soc. Japan 11, 430-3(1956) Apr.

When the absorption coefficient of the F-band of coloured alkali-halide crystal is about 2 cm^{-1}, six new bands called R_α, P_β, R_γ, R_δ, R_ϵ and R_ζ, respectively, are observed in the region between the F-band and the M-band. Molnar's R-bands (R_1 and R_2) are observed when the absorption coefficient of the F-band is about 20 cm^{-1}. The characteristic properties of these new bands are similar to those of Molnar's R-bands. (auth)

8499

SINGLE-CRYSTAL NEUTRON ANALYSIS OF TETRAGONAL $BaTiO_3$. B. C. Frazer, H. R. Danner, and R. Pepinsky (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 745-6(1955) Oct. 15.

A single crystal neutron analysis of tetragonal $BaTiO_3$ was made by cutting a c-plate with dimensions 12 mm × 2.5 mm × 0.35 mm, with an a-axis parallel to the length. Scattering data were collected on about 50 symmetry-unrelated reflections at mean neutron wavelengths of 1.063 A and 0.905 A. Resultant coordinate and isotropic temperature parameters are given. (B.J.H.)

Refer also to abstract 8328.

ELECTRICAL DISCHARGE

8500

THE EFFECT OF ATMOSPHERE MEDIA ON THE EXTRACTION OF ATOMIC SPECTRA IN ARC DISCHARGE. K. N. Mochalov, and E. L. Raff. Zhur. Tekh. Fiz. 26, 505-10 (1956) Mar. (In Russian)

Previous experiments described samples of 26 metals whose spectral characteristics changed with the change of air to pure argon atmosphere. It was established that pure argon intensified the ion lines and weakened or suppressed the lines of neutral atoms. Such redistribution of intensities of electrode substance spectral lines substantiates the concept that the atmospheric media considerably affects the process of spectra excitation by the gas participation in the processes connected with discharge mechanism. The amplification of ion lines and weakening of atomic lines result from the increase of the arc temperature of argon, as the ionization potential of argon is 15.7 ev which is considerably higher than the effective air ionization potential of 12 ev. Electrons of spectra excitation are practically in thermal equilibrium with the ions. The increased temperature increases the ionization of the electrode vapors and reduces the concentration of natural atoms. To prove the above point the air was replaced by helium media (ionization potential 24.6ev) which produced even stronger intensification of ion lines and weakening of atomic lines. Investigations were made with samples of Al, Be, V, Fe, Ca, Co, Si, Li, Mn, Mg, Cu, Ni, Ti, Cr, and Zn, in helium, argon, and air atmospheres. (R.V.J.)

ELECTRONS

8501

INCIDENCE OF AN ELECTROMAGNETIC WAVE ON A "CERENKOV ELECTRON GAS." Murray A. Lampert

(RCA Labs., Princeton, N. J.). Phys. Rev. 102, 299-304 (1956) Apr. 15.

An electron gas moving in vacuum, if sufficiently dense, acts like a mirror to an incident electromagnetic wave. A "Čerenkov electron gas," that is, an electron gas moving through or sufficiently close to a slow-wave medium at a velocity exceeding that of an electromagnetic wave in the medium, cannot, in the conventional sense, reflect the wave. A detailed analysis of this problem is presented, and it is shown that above a critical density a Čerenkov electron gas does exhibit a "mirror-like" quality; namely, it does reverse, inside the gas, the direction of propagation of an electromagnetic wave incident upon it. (auth)

8502

MOMENTUM TRANSFER CROSS SECTION AND FRACTIONAL ENERGY LOSS IN THE COLLISIONS OF SLOW ELECTRONS WITH NITROGEN MOLECULES. J. M. Anderson and L. Goldstein (Univ. of Illinois, Urbana). Phys. Rev. 102, 388-9(1956) Apr. 15.

The momentum transfer collision cross sections, q_m, of nitrogen molecules for slow electrons and the mean fractional electron energy loss, λ, in these collisions have been determined by the method of microwave interaction in gaseous discharge plasmas. The mean energy of the electron was varied from 0.04 to 0.46 ev. The cross section, q_m, was found to be $\sim 17 \times 10^{-16}$ cm^2 at 0.04 ev. It decreases to $\sim 8 \times 10^{-16}$ cm^2 at 0.46 ev. The mean fractional energy loss of the electron, λ, in the energy range investigated, was found to be ~5.5 in units of 2m/M. These results lend strong support to the theory of rotational excitation of N_2 by slow electrons. (auth)

8503

BREMSSTRAHLUNG YIELD OF HIGH-ENERGY ELECTRONS IN HYDROGEN. David Bernstein and W. K. H. Panofsky (Stanford Univ., Calif.). Phys. Rev. 102, 522-7(1956) Apr. 15.

The bremsstrahlung yield of 500- and 550-Mev electrons for the production of 235-Mev photons has been measured in liquid hydrogen. The photons are traced via the production of positive photopions in liquid hydrogen. The result demonstrates a cross section $(2.4 \pm 2.8)\%$ below the calculations of Wheeler and Lamb. The result can be accounted for by the exchange effect between the final electrons, and interference effects among the protons and electrons in molecular hydrogen. A calculation on the latter effect has been carried out using Heitler-London wave functions. (auth)

8504

HIGH-ENERGY ELECTRON-NUCLEAR SCATTERING. H. Mendlowitz (National Bureau of Standards, Washington, D. C.). Phys. Rev. 102, 527-9(1956) Apr. 15.

The Hamiltonian of a Dirac electron is transformed to a representation in which an expansion in inverse powers of the kinetic energy is facilitated. The approximation of Yennie, Ravenhall, and Wilson is readily obtained and correction terms of order $(m/p)^2$ indicated. At lower energies, it is shown that the scattering gives the gross aspects rather than the details of the charge distribution, as is well known. Effects of the spin-dependent terms in the interaction are discussed. (auth)

Refer also to abstracts 8699, 8704, 8705, and 8709.

GASES

8505 ORNL-2116

Oak Ridge National Lab., Tenn.

MEASUREMENT AND ANALYSIS OF THE HOLDUP OF GAS MIXTURES BY CHARCOAL ADSORPTION TRAPS. W. E. Browning and C. C. Bolta. Aug. 10, 1956. 23p. Contract W-7405-eng-26. $0.25(OTS).

The holdup behavior of gaseous fission products in charcoal traps was investigated as a function of trap geometry, type and amount of charcoal, trap temperature, flow rate, and type of inert gas used as purging agent. An analytical expression is presented for the calculation of holdup curves for gases when trap geometry and the adsorption isotherm for the gases on charcoal are known. (C.W.H.)

8506 RM-1650(RAND)

RAND Corp., Santa Monica, Calif.

APPROXIMATE THERMODYNAMIC PROPERTIES OF COMPRESSED HYDROGEN GAS FROM 5000 TO 12,000°K. F. R. Gilmore. Mar. 7, 1956. 9p.

For hydrogen gas at temperatures of 5000 to 12,000°K, and densities of 25 to 800 times the standard density ($\rho_0 = 8.99 \times 10^{-5}$ gm/cm^3), the equilibrium fraction of the molecules which are dissociated has been calculated, using published values for the ideal gas properties of H_2 and H. The pressure, entropy, and enthalpy of the equilibrium mixture were also calculated. Results are presented graphically. All values neglect ionization, which amounts to less than 1%, and deviations from the perfect gas law, which may amount to several per cent for the higher densities. (auth)

8507

USE OF THE BOLTZMANN EQUATION FOR THE STUDY OF IONIZED GASES OF LOW DENSITY. I. Kenneth M. Watson (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 102, 12-19(1956) Apr. 1.

The Boltzmann equation is studied for the case of a low-density ionized gas in an externally applied electromagnetic field. Particle-particle collisions are neglected, but long-range collective interactions are included. In Part I the static problem is treated in detail. For this case the Boltzmann equation is solved using individual-particle orbits—an approach which emphasizes the physical basis of the solution. (auth)

8508

USE OF THE BOLTZMANN EQUATION FOR THE STUDY OF IONIZED GASES OF LOW DENSITY. II. K. A. Brueckner and K. M. Watson (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 102, 19-27(1956) Apr. 1.

The Boltzmann equation for ionized gases of low density in an external magnetic field is used to obtain approximate solutions in the nonstatic case. The Boltzmann and Maxwell equations are linearized by assuming small deviations from a static solution. It is shown that in the limit of a strong magnetic field ($\eta \ll 1$, as defined in the text), the motion transverse to the magnetic field is described by the conventional hydrodynamic equations. The variation along field lines is described by a one-dimensional (i.e., one space dimension and one velocity dimension) Boltzmann equation. Several applications are given, including an analysis of the Kruskal-Schwarzschild gravitational instability of a plasma. (auth)

8509

ON THE TWO SCHEMES OF APPROXIMATING THE TRANSPORT COEFFICIENTS (CHAPMAN—COWLING AND HIHARA). S. C. Saxena (Indian Assoc. for the Cultivation of Science, Calcutta). J. Phys. Soc. Japan 11, 367-9(1956) Apr.

The three elementary transport coefficients and the isotopic thermal separation ratio have been evaluated over an extensive range of temperatures by utilizing the expression derived on the approximation procedure due to Kihara, for the Lennard-Jones 12:6 model. These values have been compared with the corresponding and a still higher order approximation values calculated on an alternative approximation scheme of Chapman and Cowling. The comparison

of the results obtained on the two schemes of approximation indicates that the simple expressions of Kihara are more accurate and preferable even to the corresponding higher approximation expressions of Chapman and Cowling. (auth)

Refer also to abstracts 8246 and 8346.

INSTRUMENTS

8510 AD-83639

General Electric Co. Electronics Div., Syracuse, N. Y.
NUCLEAR INSTRUMENTATION STUDIES. Final Development Report covering the period August 1, 1952 to June 1, 1955. June 4, 195[5]. 378p. Contract NObsr-57409.

Design philosophy, data, and experimental results are presented on a second harmonic type d-c to a-c converter and transistor amplifier. This combination was able to amplify d-c currents ranging from 10^{-7} to 10^{-4} amp over a temperature range of 0 to 50°C. The description and performance of an experimental pressure transmitter for use with liquid metals is presented. The development of a temperature detector for use with liquid Na up to 1000°F is reported. The design, development, construction, and testing of experimental models of transistorized d-c linear amplifiers, d-c logarithmic amplifiers, and derivative amplifiers are given. A transistor logarithmic response pulse rate computer design is presented. Neutron-sensitive phosphors and photovoltaic detectors were studied for adaptability to neutron flux measurement. Photovoltaic detectors appear quite satisfactory at flux levels above 10^{18}; neutron phosphors are destroyed at fluxes greater than 10^{14}. (D.E.B.)

8511 BRL-949

Ballistic Research Labs., Aberdeen Proving Ground, Md.
INORGANIC REPLICA TECHNIQUES FOR USE WITH THE ELECTRON MICROSCOPE. George E. Dieter. Aug. 1955. 22p. Project 5B0302001.

The polystyrene–silica two-step replica technique for the preparation of replicas from metal surfaces for examination in the electron microscope has been described in detail. The problem of interpretation of electron micrographs made from these replicas has been considered in detail. The polystyrene–carbon replica technique has been described and compared with the polystyrene–silica method. (auth)

8512 K-1300(Vol. 1, No. 1)

Union Carbide Nuclear Co. [K-25 Plant], Oak Ridge, Tenn. and Union Carbide Nuclear Co. Paducah Plant, Ky.
PATENT DEPARTMENT REVIEW. Aug. 3, 1956. 55p. Contract W-7405-eng-26. $0.40(OTS).

Some of the unclassified developments reported to the Patent Offices of Union Carbide Nuclear Co. at the USAEC facilities located at Oak Ridge, Tenn. and Paducah, Ky. are reviewed. These developments, all arising out of AEC contract work are of general interest and have not been presented in other unclassified publications. (auth)

8513 NP-5940

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
A STUDY OF THE MEMORY REQUIREMENTS OF SEQUENTIAL SWITCHING CIRCUITS. Technical Report 293. David A. Huffman. Mar. 14, 1955. 29p. Project 3-99-12-022. Contract DA36-039-sc-42607.

The number of elementary binary memory devices necessary for the realization of an arbitrary asynchronous sequential switching circuit is considered. The least upper bound is discovered to be approximately equal to twice the greatest lower bound. The minimum conceivable interstate transition time for a sequential circuit is the reaction time of a single memory element. A solution which achieves this minimum time is derived and its relationship to the Hamming single-error correction code is shown. The fundamental limitations of error correction schemes which compensate for malfunctioning of memory elements are discussed. These schemes are feasible in synchronous circuits but have slightly impaired practicability in asynchronous circuits. (auth)

8514 NP-6058

Columbia Univ., New York. Columbia Radiation Lab.
THE DEVELOPMENT OF A TUNABLE CW MAGNETRON IN THE K-BAND REGION. Special Technical Report [on] RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Zeev Fraenkel. June 1, 1956. 57p. DA Project 3-99-10-022. Contract DA-36-039-SC-64630. (CU-3-56-SC-64630-Phys.)

The development of a low field, K-band, tunable CW magnetron is described. The major characteristics of the device are presented and compared to the characteristics of other K-band magnetrons. The research leading towards the development of the magnetron is outlined. This research program had two major objectives: (a) the study of cathode back-bombardment in CW magnetrons, (b) the study of low field operation. The cathode back-bombardment was found to be closely related to two voltage regions at which large anode currents were drawn without any connection to magnetron parameters. The research program culminated in the development of a low field, K-band, tunable CW magnetron, utilizing capacitive Crown of Thorns tuning. At a fixed operating point an output power exceeding 10 watts at an efficiency exceeding 5% can be obtained over a tuning range of 7%. The tuning range can be doubled by lowering the output power requirements and making use of two operating points. (auth)

8515 TIB/T-4419

CONSTRUCTION AND TECHNICAL PROPERTIES OF HIGH-VACUUM X-RAY FLASH TUBES. '(Aufbau and Technische Eigenschaften von Hochvakuum-Röntgenblitzröhren). W. Schaaffs and K. H. Herrmann. Translated from Z. angew. Phys. 6, 23-35(1954). (AD-74889)

High vacuum x-ray flash tubes for working voltages from 40 to 400 kv are described. According to the purpose for which they are required, especially for the investigation of very rapidly changing states of the material in mechanical or acoustic processes, and examination of the microstructure in extremely short periods of time, these tubes are operated with or without ignition electrodes and with internal or external ignition control, or with a combination of both. The quality of x-ray flash tubes can be judged by the penetrating power through iron. At a mean distance of 10 cm from the focus, a layer 10 cm thick can be penetrated with certainty at 400 kv, with a single flash, lasting for an effective duration of between 10^{-8} and 10^{-6} second. The corresponding thicknesses are 4.5 cm at 300 kv, 2 cm at 175 kV, 0.6 cm at 100 kv, and 0.2 cm at 50 kv. The fluctuations of the penetrating power of the x-ray flash which are described sometimes enable as much as double these thicknesses to be penetrated. The dependence of the penetrating power on the value of the discharging capacitor is such that hardly any increase is obtained above a certain capacitance. In addition to this capacitance and the inductance of the discharge circuit, the diameter of the cathode opening has an effect on the penetrating power, which has an optimum value at about 2.2 cm diameter. Deviation from this, in either direction, reduces the penetrating power. Investigations of the focal spot of the discharge on the anode show that the size of the focus of the hard components of the polychromatic x-ray flash coincides with that of the soft

components, and of the visible light; and for conical anodes, has an average value of 0.2 to 0.3 cm diameter. (auth)

8516

ON BINARY CHANNELS AND THEIR CASCADES. Richard A. Silverman (Massachusetts Inst. of Tech., Cambridge). I.R.E. Trans. Inform. Theory IT-1, No. 3, 19-27(1955) Dec.

A detailed analysis of the general binary channel is given, with special reference to capacity (both separately and in cascade), input and output symbol distributions, and probability of error. The infinite number of binary channels with the same capacity lie on double-branched equicapacity lines. Of the channels on the lower branch of a given equicapacity line, the symmetric channel has the smallest probability of error and the largest capacity in cascade, unless the capacity is small, in which case the asymmetric channel (with one noiseless symbol) has the smallest probability of error and the largest capacity in cascade. By simply reversing the designation of the output (or input) symbols, we can decrease the probability of error of any channel on the upper branch of the equicapacity line and increase the capacity in cascade of any asymmetric channel on the upper branch. In a binary channel neither symbol should be transmitted with a probability lying outside the interval $[1/e, 1-(1/e)]$ if capacity is to be achieved. The maximally asymmetric input symbol distributions are approached by certain low-capacity channels. For these channels, redundancy coding permits an appreciable fraction of capacity in cascade if sufficient delay can be tolerated. (auth)

8517

A VERSATILE X-RAY DIFFRACTOMETER FOR SINGLE-CRYSTAL AND POWDER STUDIES. A. R. Lang (Univ. of Cambridge, England). J. Sci. Instr. 33, 138-41(1956) Apr.

A robustly constructed instrument is described which can be adapted to a wide variety of diffraction techniques. Specimen axis and counter arm are independently rotatable, manually or automatically, and are both carried by opposed tapered roller bearings. Following a predetermined programme, spectrum scanning may be performed at two speeds: slowly at angles of interest, and fast elsewhere. Graphical recorder indication of diffracted intensity can be made independent of X-ray output fluctuations by using a potentiometer reference voltage proportional to X-ray tube current. (auth)

8518

ANALOG COMPUTER FOR THE DIFFERENTIAL EQUATION $y'' + f(x)y + g(x) = 0$. Erwin Bodenstedt (Cornell Univ., Ithaca, N. Y.). Rev. Sci. Instr. 27, 218-21(1956) Apr.

A high precision electromechanical analog computer is described. The mechanical system is a torsion pendulum. Programmed torques provide an equation of motion which is identical to the equation: $y'' + f(x)y + g(x) = 0$. The solutions are obtained by recording the motion by means of a recording camera. The analog computer is used to study the betatron oscillations and the effects of resonances for the strong-focusing Cornell synchrotron. (auth)

Refer also to abstract 8710.

ISOTOPES

8519 AEC-tr-2535

SCINTILLATION COUNTING OF (n,α) AND NEUTRON FISSION REACTIONS AS AN ISOTOPIC ANALYSIS OF LITHIUM, BORON AND URANIUM. H. Wänke and E. U. Monse. Translated by Gretchen R. Riese from Z. Naturforsch. 10a, 667-9(1955). 6p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-2796.

8520

RADIO-ISOTOPE PRODUCTION IN BRITAIN. E. N. Shaw. Nuclear Eng. 1, 31-3(1956) Apr.

Business in radioisotopes is increasing steadily as shown by the figures for 1955. New reactors will provide higher specific activities. The design and manufacture of "safe" industrial sources is an important feature of production. (auth)

Refer also to abstract 8438.

ISOTOPE SEPARATION

8521 AECD-3739

Columbia Univ., New York, Div. of War Research.

OPTIMUM DESIGN OF CATALYTIC TOWERS. Harris Mayer. Mar. 12, 1943. Decl. May 14, 1954. 9p. Contract OEMsr-412. (4-R-34). $1.80(ph OTS); $1.80(mf OTS).

An arithmetic method is given for computing the number of sections required in a catalytic tower to produce a given enrichment. It also enables one to calculate the enrichment of a tower with a given number of sections. The problem of the most economical design of catalytic towers is solved. Methods are given for determining the temperature, the efficiencies of catalyst beds and strippers, the relative production rate, and the water vapor-hydrogen gas ratio which give the optimum combination of operating pressure, cross sectional area, number of sections, and volume of catalyst in the tower. Simple directions as to how to make the calculations are included. (auth)

Refer also to abstract 8740.

MASS SPECTROGRAPHY

8522 K-1294

Oak Ridge Gaseous Diffusion Plant, Tenn.

HIGH SENSITIVITY PREAMPLIFIER FOR LINE RECORDER MASS SPECTROMETER. T. J. Lewis. July 27, 1956. 42p. Contract W-7405-eng-26. $0.30(OTS).

A multi-range, high sensitivity preamplifier, for use with the standard Line Recorder d-c amplifier, has been developed which provides full-scale deflection of the amplifying system's 20-millivolt output meter for input currents of 2.5×10^{-12}, 5×10^{-13}, 1×10^{-13}, and 2×10^{-14} amperes. This report includes (1) a mathematical analysis of the characteristics of the overall Line Recorder amplifying system, (2) a history of the development work performed, and (3) a detailed description of the resulting mechanical and electronic designs. (auth)

8523

AUTOMATIC BEAM POSITIONING FOR MASS SPECTROMETERS. H. J. Lipkin and D. I. Porat (Weizmann Inst. of Science, Rehovoth, Israel). Rev. Sci. Instr. 27, 208-11 (1956) Apr.

A system is described for the control of the position of the ion beam in a mass spectrometer. The instantaneous position of the beam with respect to the point of maximum collector current is presented on a cathode-ray tube indicator. The beam can be held at this maximum point either manually using this indication, or by automatic control circuits. In automatic operation the beam first "searches" for the peak by sweeping slowly across the region of the collector plate. It is then "locked in" and hunts about the point of maximum current. The amplitude of the hunting can be made sufficiently small so that the average collector current does not differ greatly from the peak current. The beam remains locked in position during slow drifts of

magnet current and acceleration voltages. After large sudden fluctuations it returns to search operation and locks in shortly thereafter. The method of control is an adaptation of principles used in automatic frequency control of radar receivers. (auth)

MATHEMATICS

8524 NP-6043

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

NOTES ON GROUP THEORY. Technical Report No. 8. George F. Koster. Mar. 1, 1956. 184p. Contract N5ori-07856.

Notes written in the process of giving a series of lectures on group theory are reported. Topics discussed include properties of groups, representations of a group, relation of group theory and quantum mechanics, permutation groups, and the Dirac vector model, and space groups. (F.S.)

8525 ORNL-2133

Oak Ridge National Lab., Tenn.

ON PSEUDO-INVERSES OF LINEAR TRANSFORMATIONS IN B ANACH SPACES. Roy Dexter Sheffield. Aug. 2, 1956. 67p. Contract W-7405-eng-26. $0.40(OTS).

An analysis of the pseudo-inverses of linear transformations in vector spaces discusses the algebraic properties of linear transformations, the properties of linear transformations which assure the existence of continuous pseudo-inverse, and the proof that a pseudo-inverse can be used to prove the existence and uniqueness of the solution of certain nonlinear functional equations. (F.S.)

8526 OSR-TN-56-175

Columbia Univ., New York. Electronics Research Labs.

TRANSFORMATION TECHNIQUES FOR TIME-VARYING SAMPLED-DATA SYSTEMS. Technical Report T-13/B. Bernard Friedland. Jan. 2, 1956. 46p. Project R-357-50-3. Contract AF18(600)-677. (CU-20-56-AF-677-EE; AD-86597)

Components of time-varying sampled-data systems are characterized by time-variable transmission functions of the form H(n,z). An operational method for obtaining the response of feedback systems, when the transmission functions for all components are known, is presented. This method leads to a differential or functional equation for the Z-transform of the required response. W-transforms, similar to Z-transforms, are defined and used to obtain the transmission function for a cascade of components. The W-transform method is also used to find the response of feedback systems. Slowly-varying systems are considered, and an approximation which simplifies analysis for such systems is suggested. The final value theorem for fixed systems is extended to systems whose asymptotic behavior is known. It is shown that for a class of systems the asymptotic behavior can be easily determined. Stability of time-varying systems is considered. (auth)

8527 WAPD-SR-506(Vol. II)

New York Univ., New York. Atomic Energy Commission Computing Facility and David W. Taylor Model Basin. Applied Mathematics Lab., Carderock, Md.

A TABLE OF THE INTEGRAL

$$\Psi(x,t) = \frac{1}{2\sqrt{\pi t}} \int_{-\infty}^{\infty} \frac{e^{-[(x-y)^2)/4t]}}{1+y^2}\,dy$$

. VOLUME II. M. E. Rose, W. Miranker, P. Leak, L. Rosenthal, and J. K. Hendrickson. Oct. 1954. Changed from OFFICIAL USE ONLY Dec. 21, 1955. 89p. [For] Westinghouse Electric Corp. Contract AT-11-1-GEN-14. $0.50(OTS).

8528 AEC-tr-2536

NUMERICAL SOLUTION OF BOUNDARY-VALUE PROBLEMS IN ORDINARY DIFFERENTIAL EQUATIONS. (Zur Numerischen Lösung von Randwertaufgaben bei Gewöhnlichen Differentialgleichungen). E. J. Nyström. Translated from Acta Math. (Stockholm) 76, 157-84(1945). 38p.

8529 AERE-Lib/Trans-719

THE PARTIAL DIFFERENCE EQUATIONS OF MATHEMATICAL PHYSICS. R. Courant, K. Friedrichs, and H. Lewy. Translated by M. H. Rand from Math. Ann. 100, 32-74(1928). 45p.

In dealing with classical linear differential equations, if one replaces the differential coefficients by difference quotients in a grid or net—usually assumed to be rectangular—one obtains algebraic problems with a very clear structure. The present work gives an elementary discussion of these algebraic problems, with special reference to the behavior of the solutions as the lattice spacing approaches zero. In doing this, treatment is restricted to the simplest, but typical cases, so that the applicability of the method to more general difference equations and to those with any number of independent variables becomes clear. Corresponding to the familiar problems for differential equations the boundary value and eigenvalue problems for elliptic difference equations and the initial-value problem for hyperbolic difference equations are discussed. It is shown in a typical example, that "extrapolation" is always possible, namely that the solutions of the difference equation converge to the solutions of the corresponding differential equation problems; and it is also shown, that with elliptical equations inter alia, the difference quotient of any order tends towards the corresponding differential coefficient. It is never assumed that the differential equation problem can be solved. In fact a simple proof of this is obtained as the limiting case. While, however, for the elliptic case, simple convergence relations hold, which are to a large degree independent of the choice of the net, it is shown that, for the initial value problem for hyperbolic equations, the convergence is then only general if the ratios of the net spacings in different directions satisfy known inequalities, which are determined by the position of the characteristics with respect to the net. A typical example is, in the elliptic case, the boundary value problem of potential theory. Its solution from the solution of the corresponding difference equation has been extensively studied during recent years. Of course, in contrast to the present work the special properties of the potential equation are utilized, so that it is not easy to see the applicability of the method to other problems. Apart from the main aim of this work, in connection with the elementary algebraic discussion of the boundary value problem for elliptic equations, its relation to well-known statistical problems of random motion is discussed. (auth)

8530

SOLUTION OF THE LINEARIZED BOLTZMANN TRANSPORT EQUATION FOR THE SLAB GEOMETRY. Joseph Lehner and G. Milton Wing (Los Alamos Scientific Lab., N. Mex.). Duke Math. J. 23 125-42(1956) Mar.

MEASURING INSTRUMENTS AND TECHNIQUES

8531 AERE-NP/R-1770

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DESIGN OF A CERENKOV COUNTER FOR THE PROTON SYNCHROTRON AT BIRMINGHAM UNIVERSITY. J. V. Jelley. Aug. 22, 1955. 21p.

A Cherenkov detector is described which is a develop-

ment of an early design due to Getting. This detector has an optical efficiency far exceeding that of detectors previously used on accelerated proton beams. Estimates of the overall resolution indicate that this is only slightly inferior to other designs. The practical problems of applying the design to the Birmingham machine are discussed, in relation to the low flux of particles, the low repetition rate and the pulse characteristics of the external proton beam. The report concludes with remarks on the use of a vacuum photocell in place of a photomultiplier, and the associated electronics. (auth)

8532 CEA-378

France. Commissariat à L'Énergie Atomique, Paris.
DETECTION DE NEUTRONS PAR SCINTILLATIONS. (Neutron Detection by Scintillations.) J. Giraudon. Jan. 14, 1955. 32p.

The mechanisms of scintillation counting are reviewed, and the possibilities of constructing a scintillation detector for neutrons of intermediate energy are discussed. It is felt that, under rigidly controlled conditions, a large-volume liquid scintillator containing a neutron absorber such as B could be used for this purpose. (B.J.H.)

8533 CRP-632

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE CALCULATION OF LINE SHAPES IN UNGRIDDED IONIZATION CHAMBERS. J. C. D. Milton, Anne R. Rutledge, and Patricia I. K. Lennox. June 1956. 66p. (AECL-331). $1.50(AECL).

The theory of the expected line shapes in ungridded, fast collection ionization chambers is worked out and the result obtained in closed form, provided a simple assumption is made for the analytic form of the range-energy relation. The theory is otherwise completely rigorous. The assumption that range is proportional to energy does not make any serious errors for low-energy particles ($1 < E_\alpha < 3$ Mev) in all practical cases. The theory is applied to the data obtained by DeJuren and Rosenwasser for the ionization produced by the resulting particles in the $B^{10}(n,\alpha)Li^7$ reaction, and it is concluded that (Ionization of α/Ionization of Li) = 1.854 ± 0.020, whereas the ratio of the energies is 1.753. (auth)

8534 HW-41093

Hanford Atomic Products Operation, Richland, Wash.
OPERATION AND MAINTENANCE MANUAL: IN-LINE ANALYTICAL INSTRUMENTS, PUREX PLANT. Feb. 1, 1956. 116p. Contract [W-31-109-Eng-52]. $18.30(ph OTS); $6.00(mf OTS).

8535 LA-1938

Los Alamos Scientific Lab., N. Mex.
PARAFFIN CYLINDERS TO MEASURE NEUTRON ENERGIES. D. S. Young. July 1955. 25p. Contract [W-7405-eng-26].

A method is presented of measuring average neutron energies in the range from 19 kev to 4.5 Mev. When the thickness of paraffin around a B-lined chamber is increased, the counting rate at first increases and then decreases. The thickness at which the highest counting rate occurs is sensitive to the energy of the source neutrons. The optimum thickness of paraffin for an Sb–Be photoneutron source whose neutrons have been degraded to a probable average energy of 19 kev is 1.5 inches. The optimum thickness for a Po–Li source whose neutrons have a probable average energy of 250 kev is 2.0 inches, and the optimum thickness for a Po–Be source whose neutrons have a probable average energy of 4.5 Mev is 3.0 inches. From the shape of response as a function of paraffin thickness, it is possible to get an idea of the spread of neutron energies. (auth)

8536 NAA-SR-1536

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
FAST NEUTRON MONITORING WITH NTA FILM PACKETS. R. S. Hart and J. P. Hale, Jr. July 15, 1956. 22p. Contract AT-11-1-GEN-8. $0.25(OTS).

An investigation into the value of dental size NTA film packets for fast-neutron monitoring largely substantiated the results of previous work. Its accuracy, especially at or below tolerance levels, is poor. Nevertheless, in lieu of better techniques, it offers a moderately convenient method that can be easily worked into the usual β–γ personnel film system. A two-week tolerance dose of fast neutrons was represented by $\sim 3.7 \pm 1.0 \times 10^3$ proton recoil tracks per cm^2. At 970X magnification, this results in ~0.66 tracks per field. Cadmium shields were used to restrict the film response to proton recoils. Latent image fading was found to be relatively unimportant, and the proton tracks could be evaluated without serious interference with a superimposed gamma exposure up to ~5 r. The film was calibrated using a 10 curie Po–Be neutron source in several film orientation patterns. Development processes were standardized with Kodak Liquid X-ray Developer and Fix. (auth)

8537 NP-5943

Victoreen Instrument Co., Cleveland.
PHOTOCONDUCTIVE DOSE RATE INDICATOR FOR IONIZING RADIATIONS. Quarterly Progress Report No. 1 for the period October 15, 1955 to January 30, 1956. (Includes Bibliography). Lewis E. Hollander, Jr. DA Project No. 3-12-08-031. Contract DA-36-039-SC-70150.

A detailed literature survey pertaining to photoconductors in general and particularly to photoconductors for x-ray and γ-ray detection has been conducted. The appended bibliography (Appendix I) covers the results of this literature survey. The study of γ sensitive photoconductors and their development, was begun in this quarter. The light, x-ray and γ-ray sensitivities and time responses of a large sample of representative photoconductive crystals have been studied and reported below. An attempt has been made to evaluate the effect of variable impurity contents and crystal growth processes on the photoconductive characteristics. The discovery that a constant excitation greatly decreases the rise time is discussed. Phosphors with cadmium sulfide cells show no increase in efficiency. The problem of time response versus sensitivity is discussed. The avilable commercial and experimental cells are discussed and compared; also possible procedures to develop more specialized cells are outlined. (auth)

8538 NP-6039

Victoreen Instrument Co., Cleveland.
RESEARCH AND DEVELOPMENT OF PHOTOCONDUCTIVE DOSE RATE INDICATOR FOR IONIZING RADIATIONS. Quarterly Progress Report No. 2 [for] February 1, 1956 to April 30, 1956. Lewis E. Hollander, Jr. 34p. DA Project 3-12-08-031. Contract DA-36-039-SC-70150.

Emphasis in this quarter was placed on the realization of the parameters of an optimum photoconductive γ-ray detector. The effects of voltage gradient, crystal thickness, electrode area, electrode structure and impurity content on the γ response of CdS are discussed. A procedure for applying ultrasonic soldered In electrodes to CdS to a minimum by maintaining a constant exitation of sufficient intensity to just fill all the trapping states is presented. A filter yielding a ±12% energy dependence over the range of 80 kev to 1.3 Mev is described. The results of Ra selection of commercial CdS photocells are discussed. Tests with CdSe and CdS sintered layer photocells were conducted. These cells exhibited a very low γ sensitivity. (For preceding period see NP-5943.) (D.E.B.)

8539

CALCULATION OF TISSUE DOSES AND DATA FOR THE PRODUCTION OF ISODOSE CHARTS, USING STANDARD DEPTH-DOSE TABLES. Edith H. Quimby, Beverly S. Cohen, and Victoria Castro (College of Physicians and Surgeons, New York) and W. J. Meredith (Christie Hospital and Holt Radium Inst., Manchester, England). Radiology 66, 667-85(1956) May.

The method of Meredith and Neary for calculating the dose of radiation at any point within the body has been adapted to the depth-dose tables most widely used in the United States. No details of the theory are given; for these, the reader is referred to the original papers. Values of the constants involved and values of the integrals for circular and rectangular fields are tabulated, the latter being adapted from the tables developed by R. G. Mitchell. Step-by-step outlines are given of the method for finding dose at a particular point, and for computing data for isodose charts. Examples of calculated isodose charts are given, and compared with those obtained by ionization measurements in a water phantom. The accuracy with which the method represents the basic depth-dose data is discussed. (auth)

8540

A HIGH-CONTRAST PHOTOGRAPHIC RECORDER FOR SCINTILLATION COUNTER SCANNING. David E. Kuhl, Richard H. Chamberlain, John Hale, and Robert O. Gorson (Hospital of the University of Pennsylvania, Philadelphia). Radiology 66, 730-9(1956) May.

A phographic recorder is described which extends the clinical usefulness of scintillation scanning of patients who have received radioactive isotopes. High-contrast images are produced on x-ray film by a scanning light beam, the pulse frequency and pulse brightness of which increase with the count rate. The recording method offers four principal advantages: contrast enhancement, variability of contrast, background suppression, and accurate anatomical localization. Clinical trial has confirmed the usefulness of the new recording system in visualization of isotope distributions in the body. (auth)

8541

A SIMPLE THREE FOLD COINCIDENCE CIRCUIT USING ONLY ONE EQ80 (6BE7) VALVE. E. Pohl (Istituto di Fisica dell' Universita, Padova). Nuovo cimento (10) 3, 642-4(1956) Mar.

The three control grids of an EQ80 which are each separated by screen grids, when polarized to maintain the tube normally cut off, serve as inputs for the channel of a triple coincidence. The circuit is completely insensitive to single and double coincidences, and is economical both in tube and current requirements. (auth)

8542

ON THE SUBJECT OF THE SENSITIVE VOLUME OF GEIGER-MUELLER COUNTERS WITH EXTERNAL CATHODES. A. M. Baptista and J. P. Galvao (Centros de Estudos de Energia Nuclear, Lisboa). Nuovo cimento (10) 3, 647-8(1956) Mar. (In French)

8543

ALPHA COUNTING AT LOW TEMPERATURES; A METHOD TO AVOID DIFFUSION OF RADON. E. Picciotto (Universite Libre de Bruxelles) and F. Salvetti (Istituto di Chimica Generale e Inorganica dell' Universita, Rome). Nuovo cimento (10) 3, 815-19(1956) Apr. (In French)

It is shown that important errors can be made in measurements of natural α activity because of Rn diffusion. These errors can be avoided by measuring the activity of the sample when cooled to –180°C, and using a scintillation counter. (tr-auth)

8544

PORTABLE RADIATION MONITORS. D. Taylor (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Eng. 1, 15-19(1956) Apr.

Precision of operation may not be compatible with a wide variety of usage. The limitations of individual instruments are discussed with relation to the desirable characteristics that should be aimed at by a manufacturer. General agreement has been reached on ranges and energy sensitivity. (auth)

8545

ASSAY OF TRITIUM ACTIVITY IN BODY FLUIDS WITH USE OF A LIQUID SCINTILLATION SYSTEM. W. H. Langham, W. J. Eversole, F. N. Hayes, and T. T. Trujillo (Los Alamos Scientific Lab., N. Mex.). J. Lab. Clin. Med. 47, 819-25(1956) May.

8546

AN AUTOMATIC SCANNER FOR NUCLEAR EMULSIONS. S. J. Goldsack and H. B. Van der Raay (Univ. of Birmingham, England). J. Sci. Instr. 33, 135-8(1956) Apr.

A photoelectric method of obtaining the angular distribution of tracks in nuclear emulsions is outlined. Details of the apparatus constructed and its performance are given. The angular resolution is about $\frac{1}{2}°$ and the apparatus can be made to accept tracks of minimum grain density. (auth)

8547

APPLICATION OF THE ELECTROSTATIC PRECIPITATOR TO THE MEASUREMENT OF RADIOACTIVE AEROSOLS. B. A. Bergstedt (AB Atomenergi, Stockholm, Sweden). J. Sci. Instr. 33, 142-8(1956) Apr.

A continuous air monitor and a portable dust sampler are described both using a new type of electrostatic precipitator. In the continuous air monitor the dust is collected on a moving Al tape which then passes the radiation detectors. The precipitator is operated at very low efficiency, giving a high sensitivity which is nearly independent of air flow rate. The effective drift velocity of the particles towards the collection surface is more than ten times that in the Cottrell-type precipitator. (auth)

8548

A MAGNETIC ANALYSER FOR HIGH ENERGY PARTICLES. A. Lovati and H. Tyren (Univ. of Uppsala, Sweden). J. Sci. Instr. 33, 151-4(1956) Apr.

A magnetic analyser for accurate measurement of momentum of nuclear reaction products, employing two-directional focusing with a sector-shaped uniform magnetic field, is described. The instrument is useful for analysing particles with magnetic rigidity up to $2 \cdot 10^6$ G cm (corresponding to 180 Mev protons and α-particles, 90 Mev deuterons, etc.). (auth)

8549

LIQUID XENON BUBBLE CHAMBER. J. L. Brown, D. A. Glaser, and M. L. Perl (Univ. of Michigan, Ann Arbor). Phys. Rev. 102, 586-7(1956) Apr. 15.

It has been suggested that the use of liquid xenon in a bubble chamber would provide an efficient detector of γ radiation and of charged particles. The investigation of xenon as a filling liquid for bubble chambers was carried out in an Al chamber with a sensitive volume one inch in diameter and one-half inch deep along the camera axis. It was found that as a particle detector the Xe bubble chamber has properties similar to those of nuclear emulsion. (B.J.H.)

8550

EFFECT OF HYPO CONCENTRATION ON THE CLEARING TIME OF THICK EMULSIONS. Yog Prakash (Muslim Univ., Aligarh). Indian J. Phys. 29, 569-72(1955) Dec.

The variation in clearing time for different concentrations of hypo has been studied for emulsion plates of thickness, 50, 100, 200 and 400 microns at two different temperatures. A tentative explanation has been sought by considering the

various effects on the diffusion velocity of hypo. The results indicate that 35% is the optimum value of hypo concentration. (auth)

8551

HYDROGEN BUBBLE CHAMBER USED FOR LOW-ENERGY MESON SCATTERING. D. E. Nagle, R. H. Hildebrand, and R. J. Plano (Enrico Fermi Inst. for Nuclear Studies, Chicago). Rev. Sci. Instr. 27, 203-7(1956) Apr.

A 2.5 × 2.5 × 10-cm hydrogen bubble chamber has been developed for experiments on the scattering of particles from the 450-Mev synchrocyclotron. Seventy-five thousand pictures have been taken at the rate of one every two seconds and are being scanned at the rate of two thousand per day. The average track length per picture is about one gram per square centimeter. The characteristics of the bubble chamber are described and examples of the pictures are shown. (auth)

8552

NEW TIMING METHOD FOR SCINTILLATION EVENTS IN FAST COINCIDENCE EXPERIMENTS. Peter Weinzierl (Univ. of Vienna, Austria). Rev. Sci. Instr. 27, 226-9(1956) Apr.

The output pulses from scintillation detectors are amplified in conventional feedback amplifiers and transformed into a bipolar wave form, which passes the discrimination level of the following EFP 60 trigger circuit at a given time after inception of the scintillation pulse, independent of its amplitude within a wide range. If these standard pulses are shaped and fed into a fast coincidence circuit, even for NaI(Tl) resolving times of the order of 10^{-8} sec can be obtained. The main limitation of the method is due to time jitter of the standard pulses caused by statistical fluctuations of the rising edge of the photomultiplier pulses which results in a reduction of coincidence efficiency. (auth)

8553

NUCLEAR INDUCTION SPECTROMETER FOR USE AT HIGH rf INTENSITIES AND LOW TEMPERATURES. Alfred G. Redfield (Harvard Univ., Cambridge, Mass.). Rev. Sci. Instr. 27, 230-2(1956) Apr.

A nuclear induction spectrometer for the measurement of short relaxation times and the study of saturation and related phenomena is described. Radio-frequency intensities of up to 10 gauss are attainable from four to ten megacycles. Novel features of the apparatus are an rf head for use in a liquid helium cryostat, transmitter output level stabilization circuit, and a calibration circuit for comparing the intensity of the absorption at different rf levels. (auth)

8554

USE OF ARGON AS A COUNTING GAS AT -183°C. F. E. Senftle and T. A. Farley (U. S. Geological Survey, Washington, D. C.). Rev. Sci. Instr. 27, 238(1956) Apr.

8555

PROJECTION OF NUCLEAR EMULSION TRACK IMAGES. H. S. Plendl and F. E. Steigert (Yale Univ., New Haven, Conn.). Rev. Sci. Instr. 27, 239(1956) Apr.

The use of microprojection techniques to facilitate the collection of data from nuclear emulsions is discussed. Brief descriptions are given of a system consisting of a d-c carbon arc and a conventional monocular microscope. Results obtainable with this system are shown. (B.J.H.)

8556

QUANTUM EFFICIENCY MEASUREMENTS ON SEVERAL PHOSPHORS UNDER EXCITATION IN THE EXTREME ULTRAVIOLET. Donald H. Thurnau (Univ. of Colorado, Boulder). J. Opt. Soc. Amer. 46, 346-9(1956) May.

The response of several inorganic phosphors to radiation in the wavelength range of 275 A to 1715 A has been explored. The chief apparatus employed was a grazing incidence vacuum grating monochromator, using both a hydrogen arc source and an air spark source. Sodium salicylate, whose quantum efficiency is reportedly almost independent of wavelength, was used as a reference phosphor; therefore, excitation spectra are given in terms of quantum efficiency relative to sodium salicylate. Excitation spectra for $CaMg(SiO_3)_2$:Ti, $CaSiO_3$:Mn:Pb and $3Ca_3(PO_4)_2 \cdot Ca(F,Cl)_2$:Mn:Sb are limited to a range from 1026 A to 1640 A, and all show a simple decline with decreasing wavelength. $CaWO_4$:Pb and Mg_2WO_5:[W] show a minimum in quantum efficiency at about 1000 A; whereas $Zn_3(PO_4)_2$:Mn has a minimum at about 700 A. All of the latter three phosphors exhibit marked increases in quantum efficiency with decreasing wavelength in the extreme ultraviolet. (auth)

8557

APPARENT RANGE OF TRACKS IN NUCLEAR EMULSIONS. T. A. Brody (Instituto de Fisica, Universidad de Mexico). Rev. mex. fis. 4, 224-31(1955) Oct. (In Spanish)

An approximate correction formula, previously obtained empirically, for the effect of background density on track length in nuclear emulsions is confirmed experimentally. (auth)

8558

A COLLIMATED WINDOWLESS GEIGER COUNTER FOR SCANNING CHROMATOGRAMS. D. R. Bangham (National Inst. for Medical Research, London). Biochem. J. (London) 62, 550-1(1956) Apr.

A simple windowless helium–ethanol counter which operates in the Geiger region with a standard rate meter is described. It is designed to give narrow collimation and a low background suitable for scanning paper-chromatogram or electrophoresis strips. (auth)

8559

A SIMPLE HELIUM – ETHANOL FLOW COUNTER FOR MONITORING CHROMATOGRAPH-COLUMN EFFLUENTS CONTAINING WEAK β-EMITTING ISOTOPES. D. R. Bangham (National Inst. for Medical Research, London). Biochem. J. (London) 62, 552-3(1956) Apr.

A simple helium–ethanol flow counter suitable for indicating radioactivity due to weak β-emitting isotopes in the effluent from a chromatographic column is described. (auth)

8560

A DIRECT READING COUNTING RATE RATIO METER. Hirohide Miwa (Kobe Kogyo Corp., Hyogo, Japan). J. Phys. Soc. Japan 11, 458-62(1956) Apr.

A nonlogarithmic direct reading counting rate ratio meter was constructed, which proved to be more stable and precise than the logarithmic one using diode character. A counting rate f_1 of channel 1 was applied to the rate meter which is very similar to the conventional meter but with an alteration in the charging circuit of the pumping condenser, which is made to give the charge modulated by a D.C. voltage proportional to $1/f_2$ (f_2 being the counting rate of channel 2). Thus the out-put of the rate meter became proportional to f_1/f_2, or the rate ratio. The D.C. voltage proportional to $1/f_2$ was generated by utilizing a low-pass filter and a saw-tooth generator. The height of the saw-tooth voltage was made to be proportional to the pulse interval, $1/f_2$, by controlling the start and stop of the saw-tooth voltage with a pair of adjacent pulse from channel 2. The statistics of the $1/f_2$ D.C. voltage and the rate ratio was also described. (auth)

8561

STUDY OF ORGANIC SCINTILLATORS. Raymond C. Sangster and John W. Irvine, Jr. (Massachusetts Inst. of Tech., Cambridge). J. Chem. Phys. 24, 670-715(1956) Apr.

The scintillation counting behavior of a group of fifty-five pure crystalline organic compounds has been extensively studied. The data obtained have been analyzed with the goal of developing a better understanding of the scintillation process and of scintillator behavior. The materials were

carefully purified, and massive crystals were grown. Relative scintillation average-pulse-height efficiencies at 30°C and –70°C for Co^{60} gamma-ray excitation, γ excited scintillation decay times, and 2537 A ultraviolet-excited reflection and transmission photofluorescence spectra have been determined. A few solutions were also studied for comparison purposes. The purification and properties of the different materials are discussed in detail. The experimental data have been analyzed on the basis of Birks' photon cascade theory of the scintillation process. The ratio of the scintillation efficiency to the integrated photofluorescence intensity is shown to be a measure of Birks' primary photon production efficiency. The primary photon efficiencies vary over a relatively narrow range, so that there is a rough general correlation between the scintillation efficiencies and the integrated photofluorescence intensities. The best phosphors are those with rigid molecular and crystal bonding so that both the primary photon production and photofluorescence efficiencies are reasonably high. There is a tendency for the best scintillators to have the simplest and most sharply defined photofluorescence spectra. The scintillation efficiencies have been correlated with molecular structures and the mobility of the π electrons (or with the resonance interactions) within the molecules. In the simpler cases, consideration of singly charged quinoid structures permits the calculation of parameters which can be directly correlated with the scintillation efficiencies. In more complex cases, steric hindrance, hyperconjugation, "unshared" and "nonbonding" electron pairs, five-membered aromatic rings, heavy atom (triplet-state) effects, and quinoid (quenching) ground states must be considered. In all cases, the effects of thermal (vibrational) perturbations are present. "Bond density" and "bound valence" values have proved to be useful in correlating scintillation phenomena and molecular structure effects. Strongly colored compounds are usually poor scintillators. Earlier predictions of high scintillation efficiency for quinquephenyl and sexiphenyl are reaffirmed, and coronene, benzo[ghi]perylene, and 1,2,5,6-dibenzanthracene are also predicted to be significantly better than the presently known organic scintillator. The further study of compounds containing five-membered aromatic rings appears promising. A generally good correlation has been found between the scintillation efficiencies and molecular diamagnetic anisotropy values. Some relationships between the scintillation decay times and the molecular structures can also be seen. The best crystalline organic scintillators are colorless substances of high melting point possessing molecules of simple structure and low atomic number in which there is extensive resonance conjugation of rings, ethylenic double bonds, and other groups to give extended, rigidly interlocked systems. (auth)

8562

ANGULAR DISTRIBUTIONS WITH HIGH ENERGY RESOLUTION. EXPERIMENTAL METHOD. Katarina Ahnlund. Arkiv Fysik 10, No. 4, 373-85(1956).

Using the Cockcroft-Walton accelerator at the Nobel Institute, including a double-focusing magnetic heavy-particle spectrometer, angular distributions of particle groups from nuclear reactions can be measured even if these groups be very close to each other in energy (some tens of kevs). A device for turning the rotatable spectrometer automatically was outlined in an introductory paper (Mileikowsky, C., Arkiv. Fys. 1955) together with a discussion of the monitoring problem. The present report deals with practical arrangements and constructions and with the experimental procedures developed. The various factors which must be controlled in this kind of measurement are also discussed. (auth)

Refer also to abstracts 8272 and 8438.

MESONS

8563 AEC-tr-2545

OBSERVATIONS OF THE PRODUCTION AND DECAY OF UNSTABLE PARTICLES IN EMULSIONS. V. V. Al'Pers, R. I. Gerasimova, I. I. Gurevich, A. P. Mishakova, and L. V. Surkova. Translated by V. N. Rimsky-Korsakoff from Doklady Akad. Nauk S.S.S.R. 105, 236-9(1955). 12p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-2849.

8564 AERE-Lib/Trans-637

THE INTERACTION OF NEGATIVE π MESONS WITH NUCLEI OF BERYLLIUM, CARBON AND OXYGEN IN THE ENERGY RANGE FROM 140 TO 400 MEV. A. E. Ignatenko, A. I. Mukhin, E. B. Ozerov, and B. M. Pontekorvo. Translated by J. B. Sykes from Doklady Akad. Nauk S.S.S.R. 103, 395-7(1955). 4p.

Total reaction cross sections were determined by measuring the attenuation of a π^--meson beam under conditions of good geometry. Scintillation counters were used in the investigation. The resultant cross sections are tabulated and shown as a function of meson energy. (B.J.H.)

8565

DECAY IN FLIGHT OF A NEGATIVE AND A POSITIVE τ MESON. T. L. Aggson, W. B. Fretter, E. W. Friesen, L. F. Hansen, R. G. Kepler, and A. Lagarrigue (Univ. of California, Berkeley). Phys. Rev. 102, 243(1956) Apr. 1.

Measurements made on two τ mesons, one positive and one negative, which decayed in flight in a cloud chamber in a magnetic field are given. The Q-value calculated for the positive event is 84 ± 6 Mev and for the negative event is 77 ± 9 Mev. The momentum, energy, and angles of the decay products in the center-of-mass system are also given. (auth)

8566

BINDING ENERGY OF TRITIUM HYPERFRAGMENTS. D. M. Haskin, Theodore Bowen, R. G. Glasser, and Marcel Schein (Univ. of Chicago). Phys. Rev. 102, 244-6(1956) Apr. 1.

Emulsion stacks of Ilford G-5 exposed to π^--meson and K^--meson beams of the Berkeley Bevatron have been scanned for K-meson and hyperon events. An event initiated by a 3.0-Bev π^- meson is described which is interpreted as mesonic decay of a tritium hyperfragment according to the scheme: $_1H^{3*} \rightarrow p + p + n + \pi^- + Q$. All of the charged particles from the decay come to rest in the stack. The binding energy of the Λ^0 is found to be 1.4 ± 0.6 Mev. Two additional cases of the same decay scheme are described, one produced in a K^--capture star, another in a 4.3-Bev π^- star, yielding binding energies B.E.(Λ^0)≤ 1.3 ± 0.6 Mev and B.E. (Λ^0) = 3.3 ± 2.0 Mev, respectively. A weighted average of these three events gives B.E.(Λ^0) = 1.4 ± 0.5 Mev, and of all $_1H^{3*}$ events reported, including those found by other workers, B.E.(Λ^0) = 0.5 ± 0.3 Mev. (auth)

8567

SPIN OF THE Λ^0 PARTICLE. Malvin Ruderman and Robert Karplus (Univ. of California, Berkeley). Phys. Rev. 102, 247-50(1956) Apr. 1.

An analysis of the mesonic and nomesonic decay of hyperfragments shows that the spin of the Λ^0 particle is 1/2 or 3/2. If the spin is 3/2, the parity is that of the proton. (auth)

8568

MASS DEGENERACY OF THE HEAVY MESONS. T. D. Lee (Columbia Univ., New York) and C. N. Yang (Institute for Advanced Study, Princeton, N. J.). Phys. Rev. 102, 290-1(1956) Apr. 1.

Consequences of the assumption that the θ-τ mass degeneracy is not accidental, but follows from some symmetry

principle, are discussed. This assumption implies, among other things, the existence of doublets of opposite parity for all particles of odd strangeness number, such as Λ^0 and $\Sigma^{\pm}$, Σ^0. (auth)

8569

INTERPRETATION OF K^+-SCATTERING IN NUCLEAR EMULSIONS. Louis S. Osborne (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 102, 296-7(1956) Apr. 1.

A simple Born-approximation single-scattering model was used to interpret K^+ scattering in nuclear emulsions. Calculated cross sections are tabulated. (B.J.H.)

8570

INTERACTION OF 750-MEV π^- MESONS WITH EMULSION NUCLEI. M. Blau and A. R. Oliver (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 102, 489-94(1956) Apr. 15.

Interactions of 750-Mev π^- mesons with emulsion nuclei have been investigated. In scanning along 133 meters of meson track, several interactions with free protons and protons and neutrons at the edges of nuclei have been found; these events are discussed. The angular distribution of elastic π^-–p and π^-–n scattering is peaked in the forward direction. About 40% of all scatterings are inelastic with production of mesons. Characteristics of stars induced by 750-Mev π^- mesons are discussed; in particular, the relatively high frequency of stable and excited fragments in these stars seems to suggest that fragments can be emitted by direct meson interaction. (auth)

8571

HYPERFRAGMENTS AND SLOW K-MESONS IN STARS PRODUCED BY 3-BEV PROTONS. M. Blau (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 102, 495-501(1956) Apr. 15.

Emission of hyperfragments in 3-Bev proton stars has been investigated. The frequency of hyperfragments per star is 1/1000. Individual events, angular and Z-distribution are discussed. No case of associated production has been found. Five slow K^+ mesons have been found in the same emulsion volume; in 3 cases the secondary could not be identified, one case is probably a $K_{\mu 2}$ decay and one other a $K_{\mu 3}$ decay. One possible case of a K_{e3} meson is also discussed. (auth)

8572

INTERACTIONS OF NEGATIVE K MESONS. J. Hornbostel and E. O. Salant (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 102, 502-15(1956) Apr. 15.

A detailed analysis of events in nuclear emulsions caused by K^- mesons is given. Of 39 K^- mesons observed, 8 produced stars in flight, 1 underwent nuclear scattering, and 30 were captured at rest. The K^- mean free path for inelastic collisions in emulsion is 17 ± 5 cm, at most geometric. Charged by hyperons and hyperfragments were seen in 12 stars; in all others, emission of a neutral hyperon is allowed by energy balance. In $^2/_3$ of the stars, a charged pion was emitted; half of the pions had kinetic energy ≥100 Mev. 3 stars consisted only of a Σ hyperon and a pion, of such momenta as to make it obvious that K^- capture proceeded according to: $K^- + N \rightarrow Y + \pi$. Kinematic analysis shows that this reaction was the most likely process in almost all of the other captures. In 5 of the captures at rest, the pion energies were ≥100 Mev, compatible only with $Y = \Lambda^0$. One K^- capture reaction (and possibly a few more) was $K^- + 2N \rightarrow Y + N$. In this one capture, the hyperon is either $\Sigma^{\pm}$ decaying by an unusual mode, possibly into an electron, or else is a hitherto unknown particle. (auth)

8573

INTERACTION OF K-PARTICLES WITH NUCLEAR MATTER. W. B. Cheston (Univ. of Minnesota, Minneapolis). Phys. Rev. 102, 517-21(1956) Apr. 15.

The possible acceleration in nuclear matter of the decay of a K-particle whose interaction with nuclei is intrinsically weak (the K_1 particle) is investigated. Many alternative decay channels are afforded a K_1 particle in nuclear matter in contrast to the single mode of free K_1 decay. Decay through these alternative channels is shown to accelerate the decay but not to rates more rapid than $\approx 10^1 - 10^2 \tau_{free}^{-1}$. An interpretation of fragments whose total excitation exceeds that available in the case of Λ-hyperfragments in terms of a K_1 particle bound in nuclear matter seems, therefore, plausible. In addition, the absorption rates of K-particles whose interaction with nuclear matter is intrinsically strong (the K_2 particle) with and without pion emission are estimated phenomenologically. (auth)

8574

HIGH-VELOCITY PARTICLE RANGES IN EMULSION. Walter H. Barkas, Paul H. Barrett, Pierre Cüer, Harry H. Heckman, Frances M. Smith, and Harold K. Ticho (Univ. of California, Berkeley). Phys. Rev. 102, 583-4(1956) Apr. 15.

Ranges of 5 groups of mesons in Ilford G-5 emulsion were determined, the particle momentum being used as the independent parameter. Measured moments and ranges are tabulated. (B.J.H.)

8575

ON THE SPIN OF ARTIFICIALLY PRODUCED τ-MESONS. B. Bhowmik, D. Evans, I. J. van Heerden, and D. J. Prowse (Univ. of Bristol, England). Nuovo cimento (10) 3, 574-85 (1956) Mar.

Measurements have been carried out on the π-meson secondaries arising from the decay of positive τ mesons recorded in a stack of nuclear emulsions which had been exposed to the positive K-meson beam of the Berkeley "bevatron." The distribution in energy of these secondaries is shown to be consistent with the view that the τ meson is a pseudo-scalar particle, and they appear to exclude the possibility that the spin and parity of the particle are 1^-, 1^+, 2^+ or 3^-. (auth)

8576

ON A POSSIBLE SCHEME FOR HEAVY UNSTABLE PARTICLES. C. Ceolin and N. Dallaporta (Istituto di Fisica dell' Universita, Padova). Nuovo cimento (10) 3, 586-94(1956) Mar.

A level scheme is proposed for the heavy unstable particles and for their interactions with nuclei, in which an operator similar to a spin produces changes in "strangeness" analogous to the changes in charge produced by the isotopic spin. The proposed form of the interaction takes account of the experimental facts so far noted or admitted, the independent conservation of τ_3 and strangeness in strong interactions according to the ideas of Gell-Mann, and charge independence for interactions between nucleons and pions. (auth)

8577

THE CAPTURE OF NEGATIVE HYPERONS. S. J. Goldsack and W. O. Lock (Univ. of Birmingham, England). Nuovo cimento (10) 3, 600-6(1956) Mar.

Three events are described which probably represent the capture of negative hyperons. In each case, a single fast proton is emitted between 60 and 70 Mev. The present experimental data on Y^- capture are summarized and briefly discussed. (auth)

8578

ON GENERALISED DISPERSION RELATIONS. II. Abdus Salam (St. John's Coll., Cambridge) and W. Gilbert (Trinity Coll., Cambridge). Nuovo cimento (10) 3, 607-11(1956) Mar.

Considerations of an earlier paper are generalized to give down non-forward scattering, spin-flip dispersion relations. The contribution from the "bound state" is discussed. (auth)

8579

ABSORPTION OF K^--PARTICLES BY NUCLEI. W. B. Cheston (Univ. of Minnesota, Minneapolis). Nuovo cimento (10) 3, 645-6(1956) Mar.

An estimation is made of the time the K^--absorption event should take without emission of a real pion. The nucleon absorbing the K particle was considered to be coupled to the other nucleons by a static pion field. (B.J.H.)

8580

MESONIC DECAY IN FLIGHT OF A TRITON HYPERFRAGMENT. O. Skjeggestad and S. O. Sørensen (Univ. of Oslo, Norway). Nuovo cimento (10) 3, 652-4(1956) Mar.

An event representing the decay in flight of an unstable H^3 nucleus was observed in an Ilford G-5 emulsion which had been exposed at high altitudes. The event is analyzed in detail, and a projection drawing is given. (B.J.H.)

8581

A POSSIBLE METHOD FOR DETERMINING THE SPINS OF THE Σ AND OF THE Λ. R. Gatto (Istituto di Fisica e Scuola di Perfezionamento in Fisica Nucleare dell' Universita, Rome). Nuovo cimento (10) 3, 665-8(1956) Mar.

A method is presented for determining the spins of the Σ^0 and Λ^0. The method utilizes the angular correlation in the cascade decay $\Sigma^0 \rightarrow \Lambda^0 + \gamma$, $\Lambda^0 \rightarrow p + \pi^-$. For this method, measurement is required only of the angle θ between the line of flight of the emitted Λ^0 and the direction of emission of its disintegration products in the Λ^0 c.m. system. (B.J.H.)

8582

K-MESONS IN EMULSIONS EXPOSED TO A 6.2 GEV PROTON BEAM. J. Crussard, V. Fouche, J. Hennessy, G. Kayas, L. Leprince-Ringuet, D. Morellet, and F. Renard (Laboratoire de Physique de l'Ecole Polytechnique, Paris). Nuovo cimento (10) 3, 731-48(1956) Apr.

A large emulsion stack has been exposed in the 6.2-Bev proton beam of the Berkeley bevatron. 414 K^+ mesons decaying at rest have been observed. Their probable time of flight is $\sim 5 \cdot 10^{-10}$ s. 57 flat secondaries at or near minimum ionization have been extensively measured. The proportions of K_μ, χ, K_β, κ, τ and τ' are found to be respectively around 54%, 26%, 8%, 4%, 7% and 1%. They are not significantly different from the proportions in stacks exposed to the K^+ focused beam of the bevatron or to cosmic radiation, which indicates similarity in lifetimes and in relative frequencies of production for the different types of K's. The average range of 8 stopping secondaries of K_μ and of 4 stopping secondaries of χ are respectively 202.0 ± 1.9 mm and 118.8 ± 1.7 mm. The masses of K_μ and χ deduced from these ranges are very close to the masses found by direct measurement in the K beam. Two κ events with secondaries of 61.5 and 90.5 Mev have been observed. The whole evidence on κ-mesons in large emulsion stacks is examined: it is felt that the results are so far consistent with the $\kappa \rightarrow \pi^0 + \mu + \nu$ scheme. Five K^--events have been found and are described. (auth)

8583

ON THE PROPERTIES OF τ^+-MESONS. N. N. Biswas, L. Ceccarelli-Fabbrichesi, M. Ceccarelli, K. Gottstein, N. C. Varshneya, and P. Waloschek (Max-Planck-Institut fur Physik, Gottingen). Nuovo cimento (10) 3, 825-31(1956) Apr.

The properties of τ mesons were studied by observation of tracks in nuclear emulsion stacks exposed to the K^+ beam at the Berkeley bevatron. Spin and parity data are tabulated. (B.J.H.)

8584

A NOTE ON THE ANALYSIS OF τ-MESON EVENTS. Y. Eisenberg, S. Rosendorff, and Y. Yeivin (Weizmann Inst. of Science, Rehovoth, Israel). Nuovo cimento (10) 3, 837-9 (1956) Apr.

8585

HEAVY MESONS AND HYPERONS IN NUCLEAR EMULSIONS. H. Winzeler, M. Teucher, and E. Lohrmann. Helv. Phys. Acta 29, 75-82(1956) Mar. (In German)

Refer also to abstract 8700.

MOLECULAR PROPERTIES

8586 NP-6052

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 21. July 15, 1956. 54p. Contract N5ori-07856.

A series of calculations have been carried out on the ^2S ground state of Li in a study of its magnetic hyperfine structure. Computations of the electronic energy for the ground state of LiH by the self-consistent molecular orbital method are in progress and computation of the integrals for the LiH molecule at an internuclear distance of eight atomic units is very nearly completed. The calculations on the electronic energy of the OH molecule were completed. The computation of energy bands in a two-dimensional model of graphite by means of the tight binding method is reported. The lattice energy of KCl has been calculated in conjunction with a study of the electronic structure of the perfect almost pure crystal to be used as checks on an electronic structure study. The energy mass and mobility of the polaron were computed. (For preceding period see NP-5970.) (F.S.)

8587

NUCLEAR MAGNETIC RELAXATION OF NONUNIFORM SYSTEMS. S. Broersma (Northwestern Univ., Evanston, Ill.). J. Chem. Phys. 24, 659-65(1956) Apr.

The effect of electric ions in water upon the proton magnetic relaxation is discussed. Formulas pertaining to solutions of paramagnetic and nonmagnetic ions are derived. The viscosity factor occurring in the theory for uniform systems has to be replaced by an average of inverse local viscosities weighted by the dimensions of the moving particles or by individual diffusion constants. The concept of mutual viscosity—describing the interaction between two unlike liquid layers—is helpful in correlating the numeric results. The influence of temperature and concentration has been studied experimentally. The behavior of trivalent ions like Al can be understood by assuming hydration. The effect of monovalent ions can be explained on the basis of a slightly decreased diffusion constant of the free water molecules. Treated as a two-phase system, the experimental results enable the evaluation of the average time of adsorption. For Al this is 0.01 sec. (auth)

8588

SYMMETRY ASSIGNMENT OF THE SECOND EXCITED SINGLET ELECTRONIC STATE OF ANTHRACENE. David Fox (Israel Inst. of Tech., Haifa) and Shaul Yatsiv (Hebrew Univ., Jerusalem). J. Chem. Phys. 24, 1103(1956) May.

8589

VIRIAL COEFFICIENTS AND INTERMOLECULAR POTENTIAL FOR SMALL NONSPHERICAL MOLECULES. Taro Kihara, Yukio Midzuno, and Shobu Kaneko (Univ. of Tokyo). J. Phys. Soc. Japan 11, 362-6(1956) Apr.

It has been proved that for a special model of nonspherical intermolecular potential the nonspherical correction to the virial coefficients is equivalent to the quantum correction. The second and third virial coefficients of hydrogen have been investigated by use of this model, and the intermolecular potential has been determined. This is compared with the result of quantum-mechanical calculations. The model has also been applied to the second virial coefficient between argon and hydrogen. (auth)

8590
PHOSPHORESCENCE OF SODIUM- AND POTASSIUM-ACETATES. Kikusaburo Osada (Nagoya Univ., Japan). J. Phys. Soc. Japan 11, 425-9(1956) Apr.

Sodium- and potassium-acetates emit green light for a few seconds, after excitation in vacuo with radiation of 254mμ. Their spectra are composed of a green band with a maximum at 530 mμ and a blue one at 465 mμ. The phosphorescence is quenched by oxygen adsorbed in the molecular state, and the initial intensity is inversely proportional to the pressure of oxygen, but water vapour and hydrogen do not affect it at all. The intensity is also changed by the treatment of the crystal. The activation energy calculated from the temperature dependence of the lifetime is 0.034 ev. Their ultraviolet absorption spectra are also measured in aqueous or acetic acid solution to 220 mμ with a quartz spectrophotometer. From these results, it may be considered that the phosphorescence is due to imperfections of crystal. (auth)

Refer also to abstract 8255.

NEUTRONS

8591 CRDC-637
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
DETERMINATION OF NEUTRON FLUX BY MEASUREMENT OF CAPTURE GAMMA RAYS. A. W. Boyd and J. L. Whitton. Mar. 1956. 11p. (AECL-332). $0.50 (AECL).

It has been found possible to measure the variation of thermal neutron flux with height in the air annulus in the graphite reflector of the NRX reactor by measuring the intensity of gamma rays emitted on neutron capture from an absorber in this position in the reactor. The apparatus used is described, and the values obtained are compared with a measurement of thermal neutron flux made by a cobalt wire activation method in the same position. The variation in relative neutron flux for different heavy water levels in the NRX calandria is shown. (auth)

8592 DP-163
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
NEUTRON AGE IN MIXTURES OF LIGHT AND HEAVY WATER. James W. Wade. June 1956. 35p. Contract AT(07-2)-1. $0.30(OTS).

The age for fission neutrons was determined for six mixtures of D_2O and H_2O by measuring the neutron slowing-down distributions at 1.4 ev. Similar measurements were made in a lattice of aluminum rods in D_2O. In this case, the slowing-down distributions in the directions parallel and perpendicular to the rods were different, so that the age was anisotropic. (auth)

8593 NP-6053
Massachusetts Inst. of Tech., Cambridge.
RESEARCH ON THE USE OF POLARIZED NEUTRON BEAMS. Final Technical Report [for] December 20, 1955–June 15, 1956. C. G. Shull. 11p. Contract DA-19-020-ORD-3754.

A study was made of the polarizing efficiency of Fe_3O_4 crystals for quantitative comparison with predictions from known scattering amplitudes. For the study, one of the Brookhaven spectrometers was modified so as to contain both polarizing and analyzing crystals. A magnetic collimator was installed in the region between the polarizing and analyzing crystals. Resulting polarization data are given in graphical form. (B.J.H.)

8594
ON THE DETERMINATION OF DIFFUSION AND SLOWING-DOWN CONSTANTS OF ORDINARY WATER AND BERYLLIUM OXIDE, USING A PULSED NEUTRON SOURCE. R. Ramanna, G. S. Mani, P. K. Iyengar, S. B. D. Iyengar, and B. V. Joshi (Atomic Energy Establishment, Bombay, India). J. Nuclear Energy 2, 145-52(1956) Mar.

A method of obtaining the diffusion constants and the age to thermal energy of water and beryllium oxide, using a pulsed neutron source, is described. Such a method has been used in the measurement of the mean life of thermal neutrons in water and in the measurement of the diffusion length in water and heavy water. The main advantages of this method are that comparatively small quantities of the moderator material are required, and it is possible to determine the absorption mean free path, transport mean free path, and the age to thermal energy directly. In the case of water moderator of infinite dimensions, the interpretation of the decay constants depends very much on the choice of the theory. (auth)

Refer also to abstract 8536.

NUCLEAR PHYSICS

8595 NP-5947
Naval Research Lab., Washington, D. C.
NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period January–March 1956. Apr. 1, 1956. 58p.

Experimental results are discussed for studies of Coulomb excitation of V, Ni, Ga, Rb, Sn, Br, and Re; proton angular distribution from $C^{13}(He^3,p)N^{15}$, $Be^9(He^3,p)B^{11}$, $B^{10}(He^3,p)C^{12}$, and $C^{12}(He^3,p)N^{14}$; the $C^{12}(He^3,n)O^{14}$ and $C^{12}(\gamma,n)$ thresholds; β decay in Cu^{59}; proton capture resonances in Co^{59} and Na^{24}; α angular distribution in $C^{13}(He^3,\alpha)C^{12}$; Σ^+ hyperon mass; charge conjugation and the τ^0 meson; electron showers from energetic He nuclei; photoneutron thresholds of Ag^{109}, Ag^{107}, Cu^{63}, and Cu^{65}; photo-α particles from Cu; charged particle trajectories in the earth's magnetic field; and neutron inelastic scattering from Fe^{54}, Fe^{56}, and Fe^{57}. Theoretical studies of synchrotron field coils were pursued. Equations for dealing with field nonlinearities are given. Plateau and sensitivity for four-wire double-plate counters as a function of plate spacing, wire spacing, and air pressure were analyzed. Plots of these functions were prepared. A method of gaining basic heat transfer data through the use of optical techniques coupled with short duration pulse heating is described. (For preceding period see NP-5876.) (D.E.B.)

8596
ON THE RADIATION FROM INTERNAL AND EXTERNAL BREMSSTRAHLUNG AND THE SELF-IONIZATION IN THE K SHELL OF Pr^{143}. Helene Langevin-Joliot. Compt. rend. 242, 1971-4(1956) Apr. 16. (In French)

The internal bremsstrahlung spectrum obtained is in disagreement, both in form and in intensity, with theory. The number of photons goes from 160% of the theoretical value at 20 kev to 240% above 80 kev. The probability of self ionization in the K shell was found to be equal to $(4.2 \pm 0.8) \times 10^{-4}$ per disintegration. (tr-auth)

8597
MEASUREMENT OF IONIZATION BY MEANS OF THE LENGTHS OF THE PACKETS OF GRAINS IN A NUCLEAR EMULSION. Tsai-Chu, Marie-Cecile Le Gentil, and Max Morand. Compt. rend. 242, 1974-6(1956) Apr. 16. (In French)

The lengths of grain packets in emulsions group themselves dissymetrically about a definite maximum. The inte-

gral number of grain packets decreases exponentially with their length. These results are applied to the determination of the mass of particles at the end of the range. (tr-auth)

8598

COLLECTIVE OSCILLATIONS OF A "SHELL" STRUCTURE OF PARTICLES. Adnan Mouhasseb. Compt. rend. 242, 2111-14(1956) Apr. 23. (In French)

8599

THE $O^+ \rightarrow O^+$ TRANSITIONS IN Zr^{90}. Tosiko Yuasa, Jeanne Laberrigue-Frolow, and Louis Feuvrais. Compt. rend. 242, 2129-32(1956) Apr. 23. (In French)

Experimental research was done on internal conversion electrons, and the γ rays in the disintegration of Y^{90} were studied. The observation of two internal conversion β rays corresponding to a de-excitation energy of 1.74 Mev [$e_c/\beta = (1.6 \pm 0.6) \times 10^{-4}$ and the absence of the γ ray corresponding to this de-excitation ($\gamma/\beta^- < 4.3 \times 10^{-6}$) confirms the existence of a $O^+ \rightarrow O^+$ transition in Zr^{90}. (tr-auth)

8600

A POSSIBLE GENERAL SCHEME OF ELEMENTARY THREE PARTICLE INTERACTIONS. F. Duimio (Istituto di Scienze Fisiche dell' Universita, Milan). Nuovo cimento (10) 3, 595-9(1956) Mar. (In Italian)

Starting from an extension of Polkinghorne-Salam's model, in which leptons are included, equations are given by which it seems possible to explain qualitatively the decay phenomena of the elementary particles, on the basis of a weak Fermi interaction. (auth)

8601

A TEST OF NEUTRINO-ANTINEUTRINO IDENTITY. C. L. Cowan, Jr., F. B. Harrison, L. M. Langer, and F. Reines (Los Alamos Scientific Lab., N. Mex.). Nuovo cimento (10) 3, 649-51(1956) Mar.

An attempt was made to detect the simultaneous emission of two β particles in the decay of Nd^{150}. If no antineutrinos are emitted in the double decay process, the electrons should share the available energy, and the sum of their energies should be a constant. The experiment was performed by mounting a sample of Nd_2O_3 enriched to 88.23% Nd^{150} between two layers of 0.9 mg/cm^2 Al-coated Mylar film. The mounted source was then immersed in a liquid scintillator. Resultant coincidence data are shown. It is concluded from these data that the Majorana-Furry hypothesis, as applied to double β decay, does not apply to the neutrino. The assumption that the neutrino is a Dirac particle is found to be plausible. (B.J.H.)

8602

MESON-MESON INTERACTION FROM A FIELD-THEORETICAL-MODEL. B. Bosco and R. Stroffolini (Istituto di Fisica dell' Universita, Torin). Nuovo cimento (10) 3, 662-4(1956) Mar.

Recent experiments show a pronounced maximum around 900 Mev for the π^--p total scattering cross sections while the maximum does not appear in π^+-p scattering. Possible explanations of this phenomenon on the basis of meson theory are discussed. (B.J.H.)

8603

GENERAL PROPERTIES OF THE FIXED SOURCE MESON THEORY. M. Cini (Istituto di Fisica dell'Universita, Catania) and S. Bufini (Istituto de Fisica dell'Universita, Torin). Nuovo cimento (10) 3, 764-71(1956) Apr.

Three relationships connecting the renormalized and unrenormalized coupling constants to the scattering amplitudes are deduced as a rigorous consequences of the fixed source meson theory. The expressions for the scattering amplitudes deduced in the framework of the one-meson approximation and fitted to experiment in the low energy region do not satisfy these sum rules. It is shown that agreement between theory and experiment at low energy requires the high energy (above the cut-off) contributions to the sum rules to be dominant. (auth)

8604

THE ENERGY OF "FREE PRECESSION" OF NUCLEAR MAGNETIC MOMENTS. G. Laukien. Z. Naturforsch. 11a, 222-37(1956) Mar. (In German)

8605

MAGNETIC RESONANCES OF PROTONS IN ETHYL ALCOHOL. James T. Arnold (CERN, Geneva, Switzerland). Phys. Rev. 102, 136-50(1956) Apr. 1.

Studies have been made of the proton magnetic resonances of ethyl alcohol under considerably higher resolution than has heretofore been reported. A description of the apparatus includes details of construction of a large permanent magnet, with some of the considerations directed toward improvement of resolution by reduction of field inhomogeneities. Also, the features of a specially designed nuclear magnetic resonance head are described. This head is provided with facilities for spinning the sample for the further reduction of the effective field inhomogeneity. Considerations of stability of the field and the radio-frequency components are briefly discussed. Recordings of the observed spectra of ethyl alcohol are shown and are related to the predictions of calculations based on the use of a Hamiltonian which includes a particularly simple form of spin-spin interaction. The features of the spectra are finally resolved to about $\frac{1}{2}$ cps in 30 Mc/sec, and the agreement between predicted and observed structures is reasonably good. The spectra were found to be strongly modified by the presence or almost complete absence of contamination of the ethyl alcohol by H^+ or OH^- ions. The effect is attributed to an exchange process involving the hydroxyl proton of the ethyl alcohol molecule. The characteristic times between exchange events have been approximately determined for specified concentrations of H^+ and OH^- ions up to the order of 10^{-5} normal. (auth)

8606

NUCLEAR MAGNETIC RESONANCE SPECTRA OF SOME HYDROCARBONS. Weston A. Anderson (CERN, Geneva, Switzerland). Phys. Rev. 102, 151-67(1956) Apr. 1.

The study of the nuclear magnetic resonance spectrum of protons in ethyl alcohol made by J. T. Arnold has been extended to other liquid compounds which are more amenable to an exact calculation of their energy levels and transition probabilities under the influence of a small radio-frequency perturbation. Resulting recordings of these spectra are shown to be in agreement with the spectra predicted by a simple Hamiltonian proposed by Hahn and Maxwell as well as by Gutowsky, McCall, and Slichter. New evidence has been found which indicates that lines in a given spectrum have different widths. A method has been demonstrated whereby a definite spin coupling may be associated with a definite group of nuclei. This is achieved by simultaneously applying a large radio-frequency field with a frequency near to the resonance frequency of one group of nuclei and a small radio-frequency field to produce transitions within another group. In this case any structure due to the spin coupling between the two groups is greatly modified. A new and simple procedure has been demonstrated whereby the magnitude of the radio-frequency field at the sample may be accurately determined with the aid of a small auxiliary radio-frequency field. (auth)

8607

TRANSPLUTONIUM ELEMENTS IN THERMONUCLEAR TEST DEBRIS. P. R. Fields, M. H. Studier, H. Diamond, J. F. Mech, M. G. Inghram, G. L. Pyle, C. M. Stevens, S. Fried, and W. M. Manning (Argonne National Lab., Lemont, Ill.) and A. Ghiorso, S. G. Thompson, G. H. Higgins, and G. T. Seaborg (Univ. of California, Berkeley). Phys. Rev. 102, 180-2(1956) Apr. 1.

The isotopes of curium, berkelium, and californium found in the thermonuclear debris of the November, 1952 thermonuclear test are discussed. The instantaneous buildup of the heavy elements in the thermonuclear device is compared with the buildup during pile irradiation. The alpha-particle energy (5.4 Mev) and the spontaneous fission half-life ($<1.2 \times 10^7$ years) of Cm^{246} are reported. The spontaneous fission half life of Cf^{254} was found to be 55 days. No other mode of decay was observed for this isotope. (auth)

8608

IONIZATION VS ENERGY RELATION FOR FISSION FRAGMENTS. H. W. Schmitt and R. B. Leachman (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 102, 183-5 (1956) Apr. 1.

The ionization vs energy relation has been measured for fission fragments stopped in nitrogen, neon, argon, and argon plus CO_2 (3%). The fission fragments were obtained from thermal-neutron-induced fission of U^{235}. Results of these measurements are consistent with the nuclear recoil effect and show that the ionization produced is not simply proportional to the fragment energy. (auth)

8609

A NOTE ON SOMMERFELD'S BREMSSTRAHLUNG FORMULA. L. C. Biedenharn (Rice Inst., Houston, Tex.). Phys. Rev. 102, 262-3(1956) Apr. 1.

Sommerfeld's bremsstrahlung formula is discussed by the method of angular momenta. The complete correspondence in the classical limit to the work of Landau and Lifshitz is shown. (auth)

8610

NUCLEON-NUCLEON POTENTIAL WITH RELATIVISTIC CUTOFF. H. P. Noyes and S. P. Pandya (Univ. of Rochester, N. Y.). Phys. Rev. 102, 269(1956) Apr. 1.

A nucleon-nucleon potential which is a well-defined static limit of a phenomenological covariant interaction, with correct qualitative features required by scattering phenomena, is suggested. (auth)

8611

COMPTON SCATTERING AND BREMSSTRAHLUNG OF SPIN-$^3/_2$ PARTICLES. Jon Mathews (California Inst. of Tech., Pasadena). Phys. Rev. 102, 270-4(1956) Apr. 1.

The Fierz-Pauli theory of spin-$^3/_2$ in interaction with the electromagnetic field is used to calculate the cross section in Born approximation for Compton scattering by such particles. The bremsstrahlung cross section is estimated by the method of virtual quanta. The magnitude of these cross sections rules out the possibility that the mu meson is such a particle. (auth)

8612

PROTON CHARGE DENSITY. Fredrik Zachariasen (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 102, 295-6 (1956) Apr. 1.

Experiments on electron-proton scattering have given information on the structure of the charge distribution in a physical proton. Equations for the charge density are summarized, and resulting calculations are shown graphically. (B.J.H.)

NUCLEAR PROPERTIES

8613 NRDC-81

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

TABLES OF NEUTRON CROSS SECTIONS OF FISSILE MATERIALS. I. HARWELL DATA. P. A. Egelstaff, comp. Nov. 1955. 28p.

Tables covering data on slow neutron cross sections of fissile materials obtained at Harwell from 1948 to 1955 are given. Total and fission cross sections of U^{233}, U^{235}, and Pu^{239} and fission cross sections of Pu^{241} are tabulated. (F.S.)

8614 ORNL-2101

Oak Ridge National Lab., Tenn.

THE EFFECTIVE RESONANCE INTEGRAL OF U^{238} METAL. Lawrence Dresner. Aug. 2, 1956. 15p. Contract W-7405-eng-26. $0.20(OTS).

The homogeneous effective resonance integral of U^{238} metal has been calculated to be 10.1 barns at T = 300°K. This value agrees well with experiment. (auth)

8615

REMEASUREMENT OF THE MASSES OF S^{32}, S^{33}, S^{34}, AND C^{12}. G. V. Schierstedt, H. Ewald, H. Liebl, and G. Sauermann. Z. Naturforsch. 11a, 216-21(1956) Mar. (In German)

8616

NEW MEASUREMENT OF GAMMA TRANSITIONS COMBINED WITH β DECAY OF S^{37}. Th. Stribel. Z. Naturforsch. 11a, 254(1956) Mar. (In German)

8617

AN EXCITED LEVEL OF HIGH SPIN OF Gd^{154}. B. Hartmann and T. Wiedling. Arkiv Fysik 10, No. 4, 355-6(1956).

A scintillation spectrometer was used to study the excited levels of Gd^{154}. It is concluded that a spin of 6 for the 1.54-Mev level is probable. (B.J.H.)

8618

PHOTOGRAPHIC EMULSION MEASUREMENTS OF THE ENERGY DISTRIBUTION OF NEUTRONS FROM SPONTANEOUS FISSION OF CALIFORNIUM 252. I. Elis Hjalmar, Hilding Slätis, and Stanley G. Thompson. Arkiv Fysik 10, No. 4, 357-68(1956).

Earlier investigations of the energy distribution of neutrons from fission of U^{235} with thermal neutrons are briefly given. The energy distribution of neutrons from the spontaneous fission of Cf^{252} was investigated by measuring the proton recoil tracks in a photographic emulsion and was corrected for the finite thickness of the emulsion layer and for the varying neutron cross section. The influence of the finite size of the Cf sample on the energy distribution was computed. It was shown that the correction was negligible. The energy distribution of neutrons from spontaneous fission of Cf^{252} was found to be similar to that for neutrons from thermal neutron fission of U^{235}. (auth)

8619

THE POSITION OF THE SECOND EXCITED LEVEL IN C^{12}. Katarina Ahnlund. Arkiv Fysik 10, No. 4, 369-72(1956).

The second excited level in C^{12} was studied by the reaction $N^{14}(d,\alpha)C^{12}$. The Q value for the reaction was found to be 5912 ± 13 kev. Results indicate a level width of less than 25 kev in the residual nucleus. (B.J.H.)

8620

ELASTIC AND INELASTIC SCATTERING OF PROTONS ON CARBON. H. Schneider. Helv. Phys. Acta 29, 55-74(1956) Mar. (In German)

8621

PRECISION MEASUREMENT OF SINGLE PROTON RESONANCE IN LIGHT NUCLEI. F. Bumiller, H. H. Staub, and H. E. Weaver. Helv. Phys. Acta 29, 83-102(1956) Mar. (In German)

Proton resonance energies of the reactions $Li^7(p,\gamma)$ at 441 KV, $F^{19}(p,\alpha,\gamma)$ at 340 and 871 KV and $Al^{27}(p,\gamma)$ at 991 KV were measured on an absolute scale with a 180° single focussing magnetic spectrometer. The results were obtained in terms of the two atomic constants γ_p, the gyromagnetic ratio of the proton and v_c/v_k the ratio of cyclotron to spin resonance frequency of the proton. Using for these two quantities the values recently determined the

resonance energies are obtained in absolute kilovolts: Li^7 (p,γ): 441.2 ± 0.6; F^{19}(p,α,γ): 340.5 ± 0.3; F^{19} (p,α,γ): 871.3 ± 0.4; Al^{27}(p,γ): 990.8 ± 0.2. While the two first values agree very well with those obtained by various workers by abolute electrostatic deflection, the two latter values are significantly lower than those obtained by the Wisconsin group. (auth)

8622

THE QUADRUPOLE MOMENT OF V^{51}. Kiyoshi Murakawa (Institute of Science and Tech., Tokyo). J. Phys. Soc. Japan 11, 422-5(1956) Apr.

The hyperfine structure (hfs) of the spectrum of V I was investigated. From the hfs of λ 4851 the quadrupole coupling constant of the ground level $3d^34s^{24}F$ was deduced. Assuming that the screening correction for the d-electron of V I is 13, the quadrupole moment of V^{51} was calculated to be $(0.2_8 \pm 0.15)10^{-24}cm^2$, in which the polarization correction due to Sternheimer is taken into account. The indicated probable error does not include the uncertainty of the screening correction of the d-electron. In addition to the hfs of λ4851, the hfs of λλ4881, 4875, 4832, 4594, 4330 were measured, and the interval factors of the quartet levels $3d^34s^2\ ^4F$ and of $3d^34s4p^4G_{11/2}$ were obtained. (auth)

8623

NUCLEAR QUADRUPOLE LEVELS IN SINGLE CRYSTALS. Paul M. Parker (Ohio State Univ., Columbus). J. Chem. Phys. 24, 1096-1102(1956) May.

Numerical methods are used to study the behavior of the energy levels of a nucleus, having nonzero quadrupole moment and spin I = 1 or $^3/_2$, under the influence of a constant uniform external magnetic field and an electric crystalline field of axial symmetry. These numerical results are of use when experimental conditions are such that perturbation theory cannot be applied in data analysis. (auth)

8624

NUCLEAR SPIN-LATTICE RELAXATION TIMES OF AROMATIC AND ALIPHATIC PROTONS. G. W. Nederbraft and C. A. Reilly (Shell Development Co., Emeryville, Calif.). J. Chem. Phys. 24, 1110-11(1956) May.

The spin-lattice relaxation times of some structurally distinguishable proton groups in benzene, alkylbenzenes, and CS_2 solutions of benzene and alkylbenzenes were measured at 40 Mcps at 25°C. (C.W.H.)

8625

PILE NEUTRON CROSS SECTIONS OF THE HEAVIER PLUTONIUM ISOTOPES. P. R. Fields, G. L. Pyle, M. G. Inghram, H. Diamond, M. H. Studier, and W. M. Manning (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 1, 62-7(1956) Mar.

The effective pile neutron capture cross sections of the heavier Pu isotopes have been measured by irradiations in the Chalk River Reactor (NRX) and in the Materials Testing Reactor. The values in barns for Pu^{240}, Pu^{241}, Pu^{242}, Pu^{243}, Pu^{244}, and Pu^{245} were found to be: 530 ± 50, 390 ± 80, 30 ± 10, 170 ± 90, 1.5 ± 0.3, and 260 ± 145, respectively. In addition, a thermal neutron absorption cross section of 1450 ± 250 barns was found for Pu^{241} and a thermal neutron fission cross section of 1060 ± 210 barns for Pu^{241}. Using these cross sections and an assumed flux of 3×10^{14} cm^{-2} sec^{-1}, curves were calculated and plotted showing the variation in composition of plutonium as a function of integrated flux. (auth)

8626

THE THERMAL NEUTRON CAPTURE CROSS SECTION OF Np^{237}. F. Brown and G. R. Hall (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 2, 205-8(1956) Apr.

A value of 172 ± 7 barns has been obtained for the thermal neutron capture cross section of the reaction $Np^{237}(n,\gamma)Np^{238}$. The growth of Pu^{238} (the daughter of 2.1-day Np^{238}) in a sample of Np^{237} irradiated in the BEPO pile was measured by α-pulse-height analysis. The neutron flux was obtained by use of Au monitors. The Cd difference method was used to distinguish the thermal neutron process from those caused by epi-cadmium neutrons. (auth)

8627

POSSIBLE FINITE NUCLEAR SIZE EFFECT ON THE 279 KEV TRANSITION IN Tl^{203}. C. Nordling, K. Siegbahn, and E. Sokolowski (Univ. of Uppsala) and A. H. Wapstra (Instituut voor Kernphysisch Onderzoek, Amsterdam). Nuclear Phys. 1, 326-31(1956) Apr.

Discrepancies in the measurement of conversion coefficients and multipole mixing of the 279-kev transition in Tl^{203} are discussed. A source of Hg^{203} was used for the study. The absolute K conversion coefficient was determined using an iron yoke double-focusing spectrometer. K and L conversion coefficients are tabulated. (B.J.H.)

8628

EFFECT OF A SHORT-RANGE REPULSIVE INTERACTION IN THE (jj) COUPLING SHELL MODEL. G. Györgyi (Central Research Inst. for Physics, Budapest). Nuclear Phys. 1, 332-4(1956) Apr.

8629

MESIC AND NUCLEONIC CONTRIBUTIONS TO THE ANOMALOUS MAGNETIC MOMENTS. A. Petermann (Univ. of Manchester, England). Nuclear Phys. 1, 355-6(1956) Apr.

A rule is given which permits the classification of mesic and nucleonic contributions to anomalous magnetic moments. (B.J.H.)

8630

ON THE ANOMALOUS MAGNETIC MOMENTS. A. Petermann (Univ. of Manchester, England). Nuclear Phys. 1, 357-9(1956) Apr.

An expression for the nucleonic (electronic) current contribution to the anomalous moment of the nucleon (electron) is derived from the general form of the Green's function. It is shown that these anomalous moments are related to the low energy limit of Compton-like scattering processes. The simplification for practical computations is evident. (auth)

8631

GAMMA-GAMMA ANGULAR CORRELATION IN ^{46}Ti. G. Bertolini, M. Bettoni, and E. Lazzarini (Istituto di Fisica Sperimentale del Politecnico, Milan). Nuovo cimento (10) 3, 800-5(1956) Apr.

The directional angular correlation of the γ-γ cascade of Ti^{46}, obtained from Sc^{46} is studied. The correlation function is represented by the formula: $W(\theta) = 1 + 0.1006P_2(\cos\theta) + 0.0178P_4(\cos\theta)$. (auth)

8632

NEW ISOTOPE OF BERKELIUM. E. K. Hulet (Univ. of California Radiation Lab., Livermore). Phys. Rev. 102, 182(1956) Apr. 1.

A new isotope of berkelium, Bk^{248}, formed by a 25-Mev helium-ion bombardment of a mixture of curium nuclides has been found. Its existence and a half-life of 23 ± 5 hours were determined by periodically separating the β^- decay daughter, Cf^{248}, from the mixture of berkelium isotopes isolated after the bombardment. (auth)

8633

EXCITATION FUNCTIONS AND YIELD RATIOS FOR THE ISOMERIC PAIRS $Br^{80,80\,m}$, $Co^{58,58m}$, AND $Sc^{44,44m}$ FORMED IN (p,pn) REACTIONS. J. W. Meadows, R. M. Diamond, and R. A. Sharp (Harvard Univ., Cambridge, Mass.). Phys. Rev. 102, 190-5(1956) Apr. 1.

Excitation functions and yield ratios for isomeric pairs have been measured from near threshold to 100 Mev for

three (p,pn) reactions. The results are interpreted in terms of the spins of the states involved, the angular momentum of the bombarding particle, competition between compound nucleus formation and the knock-on mechanism and the level density in excited nuclei as a function of spin. (auth)

8634

ISOTOPES OF EINSTEINIUM AND FERMIUM PRODUCED BY NEUTRON IRRADIATION OF PLUTONIUM. J. Jones and R. P. Schuman (Knolls Atomic Power Lab., Schenectady, N. Y.) and J. P. Butler, G. Cowper, T. A. Eastwood, and H. G. Jackson (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 102, 203-7(1956) Apr. 1.

Samples of einsteinium and fermium have been separated from neutron-irradiated plutonium and carefully purified. Four isotopes of einsteinium were found: 20.03-day E^{253}, emitting 6.636-Mev and 6.24-Mev alpha particles and 42- and 393-kev gamma rays, both magnetic dipole transitions, and with a spontaneous fission half-life of 7×10^5 years; 38.5-hr E^{254m}, a beta emitter with 1.04-Mev beta rays and 0.680-Mev gamma rays; ~320-day E^{254}, an alpha emitter with 6.42-Mev alpha particles; and 24-day E^{255}, a beta emitter. Two fermium isotopes were found: 3.24-hr Fm^{254} emitting 7.20-Mev alpha particles and with a spontaneous fission half-life of 246 days; and 21.5-hr Fm^{255} emitting 7.08-Mev alpha particles. (auth)

8635

GAMMA RAYS FROM THE PROTON BOMBARDMENT OF Mg^{24}. A. E. Litherland, E. B. Paul, G. A. Bartholomew, and H. E. Gove (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 102, 208-22(1956) Apr. 1.

The reactions $Mg^{24}(p,\gamma)Al^{25}$, Q = 2.29 Mev, and $Mg^{24}(p,p'\gamma)Mg^{24}$, Q = −1.37 Mev, have been measured for proton energies in the range 0.40 to 3.0 Mev. New levels in Al^{25} have been found at 1.61, 3.44, 4.90, 5.06, 5.10 Mev, and possibly at 5.09 Mev. Appropriate angular distribution measurements of proton-capture gamma rays and gamma rays from inelastic proton scattering, combined with previous measurements by other investigators, allow unambiguous spin and parity assignments to be made for all known levels in Al^{25} up to 4.7 Mev with the exception of those at 1.61, 2.51, and 3.44 Mev, where the assignments are less certain. The gamma-ray branching ratios for all the levels up to 4.7 Mev have been measured, as well as absolute values of the product of Γ_p/Γ and the partial widths for primary gamma transitions and inelastic proton scattering for states above the proton binding energy. In several cases, intensity ratios of E2−M1 mixtures were obtained. An interpretation of some of the results based on a collective model of the Al^{25} nucleus is given. (auth)

8636

NEUTRON CROSS-SECTION MEASUREMENTS OF ANTIMONY, GALLIUM, CADMIUM, AND MERCURY. R. Ronald Palmer and Lowell M. Bollinger (Argonne National Lab., Lemont, Ill.). Phys. Rev. 102, 228-36(1956) Apr. 1.

The results of neutron transmission measurements on antimony, gallium, cadmium, and mercury, and on their separated isotopes are presented. Several methods are described for finding resonance parameters from neutron transmission measurements. Level parameters are reported for six resonances of Sb^{121}; four of Sb^{123}; three for Ga^{69}; four for Ga^{71}; and one each for Cd^{110} and Cd^{111}. Isotopic assignments are made for three resonances in mercury. (auth)

8637

THERMOMOLECULAR PRESSURE RATIOS FOR He^3 AND He^4. Thomas R. Roberts and Stephen G. Sydoriak (Los Alamos Scientific Lab., N. Mex). Phys. Rev. 102, 304-8 (1956) Apr. 15.

Thermomolecular pressure ratios of He^3 have been measured for a tube extending from room temperature to a bulb at 2°K. The results agree within experimental accuracy with He^4 ratios calculated from the Weber-Schmidt equation. Detailed calculations from this equation are given. Limitations of the equation due to large deviations from ideal viscosity behavior in the liquid helium range are discussed. (auth)

8638

DIFFERENTIAL CROSS SECTION FOR PROTON-HELIUM SCATTERING NEAR 17.5 MEV. Karl W. Brockman, Jr. (Princeton Univ., N. J.). Phys. Rev. 102, 391-6(1956) Apr. 15.

The differential cross section for the elastic scattering of 17.45 ± 0.2-Mev protons by He has been measured at 33 angles between the center-of-mass angles 6.4 to 168 degrees. An external beam of protons from the Princeton cyclotron was scattered by He gas in the interior of the Princeton 60-inch precision scattering chamber, scattered particles being detected in a KI scintillation counter. Values found for the cross section are considered to have an overall accuracy of 2% except at the smallest angles where the error was larger due to experimental difficulties. The resulting data have been analyzed in terms of phase shifts of the S, P, D, and F waves with the following results: S, −100.7°; $P_{3/2}$, 81.2°; $P_{1/2}$, 36.4°; $D_{5/2}$, 157.8°; $D_{3/2}$, 10.9°; and F, 1.2°. These values provide a least-squares fit to the experimental curve. (auth)

8639

DIRECTIONAL CORRELATIONS AND ELECTRIC QUADRUPOLE MOMENTS OF MERCURY ISOTOPES. R. V. Pound and G. K. Wertheim (Harvard Univ., Cambridge, Mass. and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 102, 396-9(1956) Apr. 15.

The directional correlation of the 368-kev and the 159-kev γ rays of 44-min Hg^{199} were studied with sources in the form of liquid metal, frozen metal, and dry crystalline $HgCl_2$. The results in the liquid metal, if free of scattering and of disturbances in the intermediate state, indicate a mixing of 0.8% E5 with the predominantly M4 first γ ray, assuming the second to be pure E2. The disturbance observed in the frozen metal suggests a static electric quadrupole interaction $eQ(\partial^2V/\partial z^2)/h$ of 593 Mc/sec whereas that in $HgCl_2$ suggests similar interaction of 1100 Mc/sec for the 2.35-mμsec intermediate state. If the second γ ray is a rotational transition, an intrinsic quadrupole moment determined from the intermediate lifetime can be used together with these values and the coupling observed for Hg^{201} in $HgCl_2$ to compute the electric quadrupole moment of Hg^{201}. The resulting value of $0.46^{+0.28}_{-0.11}$ barn is in excellent agreement with the spectroscopically determined value of 0.45 ± 0.04 obtained by Murakawa. (auth)

8640

GAMMA-GAMMA ANGULAR CORRELATION IN Sr^{88}. Ernest D. Klema (Oak Ridge National Lab., Tenn.). Phys. Rev. 102, 449-50(1956) Apr. 15.

The directional angular correlation of the 909−1850-kev γ−γ cascade in Sr^{88} has been measured with a coincidence scintillation spectrometer using NaI detectors. For a dilute YCl_3 aqueous solution source, the observed correlation function, after correction for the finite angular resolution of the detectors, is given by $W(\theta) = 1-(0.0699 \pm 0.0025)\ P_2(\cos\theta)$. The theoretical correlation function for the sequence 3(D)2(Q)0 is $W(\theta) = 1-0.07143\ P_2(\cos\theta)$; hence it is concluded that both of the transitions in the cascade are pure multipoles. (auth)

8641

THEORY OF THE 0^+ STATES OF O^{16}. Richard A. Ferrell and William M. Visscher (Univ. of Maryland, College Park). Phys. Rev. 102, 450-2(1956) Apr. 15.

The usual shell-model interpretation of the 6.06-Mev 0^+ level of O^{16} as two-nucleon excitation is replaced by one-nucleon excitation. The large excitation energy for an individual nucleon is greatly reduced for special linear combinations of the excited shell-model configurations because of a resonance effect arising from the degeneracy and from the large off-diagonal matrix elements. The state of collective compressional-dilational oscillation of the nucleus is shown to be a particularly favorable such linear combination, and the results of an explicit calculation indicate that the resonance effect is strong enough to account for the 6.06-Mev level. It is also proposed to interpret the 6.91-Mev 2^+ level as a superposition of one-nucleon excited configurations corresponding to spheroidal deformation. (auth)

8642

SELF-CONSISTENT FIELD CALCULATION OF THE NUCLEAR BOUNDARY DIFFUSENESS. James D. Talman (Princeton Univ., N. J.). Phys. Rev. 102, 455-7(1956) Apr. 15.

A lower limit to the nuclear boundary diffuseness parameter σ, defined by fitting to the density a function of the form $\rho = \rho_0\{1 + \exp[(r-\alpha)/\sigma]\}^{-1}$, has been estimated by carrying out the first stage of a self-consistent field calculation. The result is in agreement with present experiments, but it is expected that succeeding calculations will yield an appreciably larger result. (auth)

8643

ANGULAR CORRELATION OF Os^{188}. V. R. Potnis, V. S. Dubey, and C. E. Mandeville (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 102, 459-61(1956) Apr. 15.

The quantum radiations of Re^{188} have been examined with the aid of coincident scintillation spectrometers. In addition to those already known, gamma rays have been detected at energies of 1300 and 1770 kev. The spatial correlation function of the 480-kev–150-kev cascade has been determined and corresponds to a 2-2-0 scheme with E2 heavily mixed (99.56%) in M1 in the case of the 480-kev transition. (auth)

8644

PROPERTIES OF Fm^{252}. A. M. Friedman, J. E. Gindler, R. F. Barnes, R. Sjoblom, and P. R. Fields (Argonne National Lab., Lemont, Ill.). Phys. Rev. 102, 585-6(1956) Apr. 15.

A Fm^{252} sample was prepared by α bombardment of californium, and the alpha decay of Fm was studied. The alpha decay energies show a marked anomaly at 152 neutrons as is the case for the californium isotopes. (B.J.H.)

8645

CALCULATION OF REDUCED WIDTHS FROM STRIPPING CROSS SECTIONS. W. Tobocman (Institute for Advanced Study, Princeton, N. J.). Phys. Rev. 102, 588-9(1956) Apr. 15.

The Bowcock method of using the Butler theory of deuteron stripping to extract reduced widths from experimental (d,p) cross sections was tested, and results are presented in both graphical and tabular form. (B.J.H.)

8646

RELATED jj-COUPLING CONFIGURATIONS IN K^{40} AND Cl^{38}. S. Goldstein and I. Talmi (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 102, 589-90(1956) Apr. 15.

Deviations from jj-coupling configurations in K^{40} and Cl^{38} are discussed briefly. (B.J.H.)

8647

NUCLEAR SPINS OF Mo^{95} AND Mo^{97}. J. Owen and I. M. Ward (Clarendon Lab., Oxford, England). Phys. Rev. 102, 591-2(1956) Apr. 15.

Measurements were made to confirm paramagnetic resonance measurements of the nuclear spins of Mo^{95} and Mo^{97} giving $I = 5/2$. Measurements were made on crystals grown from an HCl solution containing the diamagnetic salt $K_3(InCl_6)\cdot 2H_2O$ and the paramagnetic salt $K_3(MoCl_6)$. (B.J.H.)

8648

FISSION CROSS-SECTIONS AS A FUNCTION OF NEUTRON ENERGY. II. PLUTONIUM-239 AND PLUTONIUM-241. R. Richmond and B. T. Price (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 177-86(1956) Mar.

The fission cross-section of Pu^{239} has been compared with the (n, α) cross-section of B^{10} by means of experiments carried out on the BEPO slow-neutron velocity selector, the BEPO single-crystal neutron spectrometer, and the 15-Mev linear accelerator. The measurements covered the neutron energy range 0.007 to 700 ev. Fission resonances were resolved at the following energies: 0.30, 8.0, 11.2, 15.1, 18.3, 22.8, and 26.8 ev. The fission cross-section of a mixture containing Pu^{241} has been compared with the fission cross-section of Pu^{239} over the neutron energy range 0.04 to 0.4 ev, and with the (n, α) cross-section of B^{10} over the range 0.2 to 70 ev. Fission resonances in Pu^{241} were observed at 0.255 ± 0.02 ev and 4.45 ± 0.1 ev. (auth)

8649

THE SLOW NEUTRON TOTAL CROSS SECTION OF PLUTONIUM. N. J. Pattenden (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 187-92(1956) Mar.

The neutron total cross section of Pu samples of different isotopic composition was measured from 0.0015 ev to 25 ev. Results are presented graphically. (C.H.)

NUCLEAR REACTORS

8650 AERE-C/M-262

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FISSION PRODUCT GASES FROM A HOMOGENEOUS POWER REACTOR. P. C. Davidge and C. J. L. Lock. Nov. 1955. 16p. (HARD/P-7; RCTC/P-58)

The activity, heat release, and weight of the fission product gases and their daughter products which will be removed from a 140-Mw reactor has been calculated. The way in which these results can be applied to other reactor power levels has been indicated. (auth)

8651 AERE-R/R-1225

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A TWO GROUP ANALYSIS OF Z.E.T.R. EXPERIMENTS. F. W. Fenning, C. C. Horton, and J. D. McCullen. Nov. 24, 1955. 23p.

A two-group analysis has been applied to the ZETR results with the intention of deriving a value of η for Pu. This value of η has then been used in further two-group calculations for bare and water-reflected spheres, infinite cylinders and infinite slabs with cores of $Pu-H_2O$ solutions and Pu nitrate in 5N HNO_3 solutions. (auth)

8652 AERE-RP/R-1776

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DIFFUSION THEORY OF THERMAL NEUTRON FINE STRUCTURE IN REACTORS WITH NON-UNIFORM SPACING OF THE FUEL ELEMENTS. PART I. D. A. Newmarch. Oct. 27, 1955. 27p.

Expressions for the thermal neutron fine structure,

thermal utilization factor, and resonance escape probability are obtained for the case of an infinite reactor where the fuel elements are in the form of slabs which are grouped instead of being uniformly distributed throughout the system. (auth)

8653 AERE-T/R-528

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CRITICAL RADIUS OF AN INTERMEDIATE REACTOR. B. Davison. May 1950. Decl. June 7, 1956. 24p.

An intermediate reactor is understood here as a reactor in which a vast majority of fissions are caused by neutrons whose energy is very much less than fission neutron energy, and at the same time very much larger than thermal energies. The critical radius of a spherical intermediate reactor is determined for two cases: in absence of a reflector, and in the presence of an infinite reflector, absorbing and slowing down neutrons in the same manner as the core. In the first case the critical radius a is given by the equation $1 = \int_0^{E_0} f(E)\,\eta(E) \exp\{-[\pi L_S(E)/\alpha]^2\}\,dp\,(E)$ in which E_0 is the mean energy of fission neutrons, p(E) is the probability for a neutron to survive in an infinite medium down to the energy E and f(E) is the probability that a neutron absorbed at the energy E is absorbed in the fissile material rather than in the other material composing the core, while the other symbols have the usual meaning. For the second case two alternative methods of approximate determination of the critical radius are discussed. (auth)

8654 AERE-T/R-1903

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CRITICALITY CALCULATIONS BY MONTE CARLO METHODS. K. W. Morton. Mar. 1956. 50p.

Monte Carlo methods were developed which are suitable for use in any criticality problem. Applications are given for particular problems. (F.S.)

8655 CF-54-7-38

Oak Ridge National Lab., Tenn.

ORACLE CODE FOR THE TWO-GROUP, TWO REGION HOMOGENEOUS REACTOR CALCULATION. T. B. Fowler and R. A. Willoughby. July 7, 1954. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A machine code has been written for the two-group, two-region spherical homogeneous reactor problem for use with the Oracle. A brief description of the method of calculation, the input parameters, the output data, and detailed instructions for using the code is included. (auth)

8656 CF-56-7-127

Oak Ridge National Lab., Tenn.

TBR PLANT TURBOGENERATOR SYSTEM STUDY. W. F. Taylor. June 27, 1956. 27p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A 100-Mw turbogenerator station for use with the TBR was designed. An optimization study indicated the choice of 370 psia and 437°F as plant operating conditions. The plant cost, flow diagrams, and component specifications are given. (D.E.B.)

8657 CRRP-606

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

METHOD OF STUDYING MULTI-REGION REACTORS WITH AN ANALOG COMPUTER. J. G. Bayly and R. M. Pearce. Apr. 6, 1956. 36p.

An electrical analog is described for the study of nuclear reactors whose nuclear properties vary with radius. Several neutron-velocity groups can be used. When two groups are used, the reactor can be divided into as many as twenty spherical or cylindrical regions in which the parameters of the two-velocity-group theory may be independently varied. The analog simulates the critical condition of the reactor and also yields the distribution in space of the various neutron groups. It has been possible to adapt a commercially available, general purpose analog computer to this problem. The analog can also solve the adjoint equations to obtain the "importance" functions. (auth)

8658 CRRP-634

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

FISSION PRODUCT ACCUMULATION. W. H. Walker. Mar. 15, 1956. 53p.

The concentrations of individual fission products and their cross sections for neutron capture have been calculated in terms of fissile atom concentration for U^{233}, U^{235} and Pu^{239}. Calculations cover the range of integrated flux from 0.3 to 3.0 neutrons per kilobarn for three values of the flux – 10^{13}, 10^{14} and 10^{15} neutrons per cm^2 per sec. The nuclear data used in these calculations are given, with references to the sources from which they were obtained. Individual fission product contributions are tabulated for fuel poisoning by fission products for which the capture cross section is known, for the upper limit of poisoning possible where only the upper limit of the capture cross section is known, and for concentrations of those fission products for which the cross section is unknown. Total effects for each fissile material are summarized for all combinations of flux and integrated flux. This information is also presented graphically. (auth)

8659 HW-41896

Hanford Atomic Products Operation, Richland, Wash.

ANALYSIS OF THE TRANSIENT CONDUCTION OF HEAT IN LONG SOLID CYLINDRICAL FUEL ELEMENTS FOR NUCLEAR REACTORS. F. E. Tippets. May 1, 1956. 65p. Contract W-31-109-Eng-52. $0.40(OTS).

A mathematical procedure using the finite Hankel transform is employed to obtain a solution for the transient heat flux and radial temperature distribution in a long solid cylindrical nuclear reactor fuel element. The conditions assumed are: axial symmetry; constant material properties, sink temperature and boundary conductance; and a heat generation rate which varies radially in accordance with thermal neutron diffusion theory and is any arbitrary function of time. The equations are used to compute numerical examples for comparison with the results of more approximate methods. An attempt is made to show by numerical evaluation the effect on the accuracy of the computed results of changes in material properties and heat transfer coefficients over the range experienced in one of the Hanford reactors. In order to provide a means of attack on reactor transient problems involving large changes in the coolant temperature, an adaptation of the analytic solution appropriate for use in a step-wise calculation procedure is developed. The results obtained are applicable in general to the problems of transient cooling of heterogeneous reactors employing long solid cylindrical fuel elements. (auth)

8660 IDO-16244

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

NEUTRON LIFETIME BY THE RUMSEY METHOD. J. W. Webster. Sept. 30, 1955. 19p. Contract AT(10-1)-205. $0.20(OTS).

Details are given on a method due to V. H. Rumsey for calculating the average neutron generation time in a reflected reactor. The method is applied to cylindrical geometry. (auth)

8661 IGE-R-11

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

THE MAXIMUM POSSIBLE EFFICIENCY OF A REACTOR, HEAT-EXCHANGER COMBINATION. G. Packman. Feb. 10, 1956. 8p.

An expression is found for the ideal efficiency of a thermodynamic cycle using heat at the temperatures of the coolant through a convection-cooled reactor. The expression is extended to include the loss due to the temperature drop in the heat exchanger, and is put forward as a reasonable standard with which to compare the performance of such a plant. (auth)

8662 NAA-SR-1535

Atomics International Div., North American Aviation, Inc. Canoga Park, Calif.

BUCKLING OF GRAPHITE MODERATED LATTICES CONTAINING SEVEN ROD FUEL CLUSTERS. F. L. Fillmore. Aug. 1, 1956. 18p. Contract AT(04-3)-49. $0.20(OTS).

Buckling and intracell flux measurements have been made on three graphite moderated exponential assemblies each having seven rod enriched U fuel clusters. Theoretical values of the buckling are calculated and compared to the experimental values. In evaluating the resonance escape probability, two values are used for the lethargy spread of resonance neutrons. The larger value of 5.6, which appears in most of the literature, compares less favorably with the experimental values than does the smaller value 2.6. The theoretical buckling compares favorably with experimental values for the two larger lattice spacings and is about 10 per cent low for the smallest lattice spacing. (auth)

8663 NAA-SR-1546

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

INTRACELL FLUX DISTRIBUTIONS FOR AN EXTENSIVE SERIES OF HEAVY WATER, URANIUM ROD LATTICES. Olga W. Heinzman and Sidney W. Kash. Aug. 1, 1956. 19p. Contract AT-11-1-GEN-8. $0.20(OTS).

Intracell flux data are presented for an extensive series of heavy water, uranium rod lattices. Three enrichments of uranium fuel were used: depleted, natural and slightly enriched, that is, 0.49, 0.71 and 0.90 wt. % U^{235}, respectively. The fuel rod diameters ranged from $\frac{3}{4}$ to 2 inches and the lattice spacings from 3 to 12 inches. The data of four special lead–cadmium alloy lattices and three single rod "lattices" are also presented. (auth)

8664 NAA-SR-1567

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

CONTROL ROD EVALUATION BY MEANS OF PERTURBATION THEORY. F. L. Fillmore. July 15, 1956. 30p. Contract AT-11-1-GEN-8. $0.25(OTS).

The reactivity of boron–nickel control rods in the SRE reactor is evaluated by perturbation theory. A simple procedure for obtaining reasonable approximation for the perturbed flux is given. The value of reactivity calculated by perturbation theory for the case of a black rod along the axis of the core is compared with the result obtained from an exact solution of the problem. A diffusion theory correction for semi-black rods is given. The value of a 4-rod pattern in the core is calculated by applying statistical weights. Conversion from a bare to a reflected reactor is given. The effect of moderator temperature on the reactivity controlled by the rod is discussed. (auth)

8665 NAA-SR-Memo-784

[North American Aviation, Inc., Downey, Calif.]

PRELIMINARY OUTLINE OF THE CRITICAL ASSEMBLY AND INITIAL OPERATIONAL TESTING OF L-3 REACTOR. M. E. Remley. Sept. 25, 1953. 26p. $4.80(ph OTS); $2.70(mf OTS).

The proposed procedures for the critical assembly of the L-3 reactor are described in detail. The assembly will be performed at the reactor installation at California Research and Development Company at Livermore, California. The assembly will be conducted by members of the North American Aviation staff in cooperation with members of the California Research and Development staff. The procedures for the assembly have been designed for efficient loading of the reactor core consistent with maximum safety throughout the assembly. (auth)

8666 NYO-4720

Technical Operations, Inc., Arlington, Mass.

THE STATUS OF THE REACTOR SAFETY PROGRAM. July 17, 1956. 7p. Contract AT(30-1)-1889. (TOW-57-3-1A). $1.80(ph OTS); $1.80(mf OTS).

8667 ORNL-2085

Oak Ridge National Lab., Tenn.

ADMINISTRATIVE CONTROL OF A RESEARCH REACTOR. J. A. Cox. Aug. 10, 1956. 7p. Contract W-7405-eng-26. $0.10(OTS).

In addition to instrument control over the reactor and experiments, safe operation requires strong administrative control. In 12 years of operation of the Graphite Reactor and five years of operation of the Low Intensity Test Reactor at Oak Ridge National Laboratory, no serious incidents have occurred. Administrative controls used to safeguard the reactors and personnel without undue interference with experiments are described, along with some of the hazards encountered in operation of research reactors. (auth)

8668 ORNL-2086

Oak Ridge National Lab., Tenn.

A METHOD FOR THE DISPOSAL OF VOLATILE FISSION PRODUCTS FROM AN ACCIDENT IN THE OAK RIDGE RESEARCH REACTOR. F. T. Binford and T. H. J. Burnett. Aug. 2, 1956. 11p. Contract W-7405-eng-26. $0.15(OTS).

The Oak Ridge Research Reactor is a fully enriched, heterogeneous, light-water-moderated and -cooled, beryllium-reflected reactor of the MTR-BSF type. It is designed to operate at a power level of 20 to 30 megawatts with a thermal-neutron flux of the order of 10^{14}. In this paper the maximum credible accident is postulated to be that situation in which the reactor suffers from a deficiency in cooling capacity sufficient to cause melting of the fuel elements and subsequent release into the building of all the volatile fission products. It is shown that with properly engineered ventilating and gas-scrubbing equipment the radioactive gas can be disposed of in such a way as to prevent harmful exposure to persons in the surrounding area. Direct radiation from the large mass of gas initially present in the building will be extremely intense in the immediate vicinity of the building. It is possible, however, through the use of a suitable alarm system, to evacuate this area in a time short enough to prevent serious over-exposure to personnel. (auth)

8669 ORNL-2090

Oak Ridge National Lab., Tenn.

A PHILOSOPHY OF CONTROL-SYSTEM DESIGN. E. P. Epler. July 27, 1956. 9p. Contract W-7405-eng-26. $0.15(OTS).

Generalized control systems, incorporating methods of proven worth, which may be quickly constructed with standardized components and which are capable of meeting any reasonable performance demand, are needed. Modular

assemblies of rod and chamber drives are being rebuilt as well as modular operating and relay subpanels. (F.S.)

8670 ORNL-2091

Oak Ridge National Lab., Tenn.

CONTAINMENT PROBLEMS IN AQUEOUS HOMOGENEOUS REACTOR SYSTEMS. S. E. Beall. Aug. 8, 1956. 16p. Contract W-7405-eng-26. $0.20(OTS).

Containment problems in homogeneous reactors are discussed, with particular emphasis given to the manner in which they have been solved for the HRT. Bases for rigid leakage specifications on reactor components are explained. The design of the reactor enclosure is reviewed with respect to allowable leakage, as well as protection against fragments and internal pressures resulting from a reactor catastrophe. (auth)

8671

THERMAL POWER FROM NUCLEAR REACTORS. A. Stanley Thompson and Oliver E. Rodgers. New York, John Wiley and Sons, Inc., 1956. 229p. London, Chapman and Hall, Ltd.

The application of nuclear reactors to the production of thermal power is discussed from the mechanical engineer's viewpoint. Discussion is limited to heat generation, heat removal, and the use of heat from reactors in thermal plants. (F.S.)

8672

CONTROL OF NUCLEAR REACTORS AND POWER PLANTS. M. A. Schultz. New York-Toronto-London, McGraw-Hill Book Co., Inc., 1955. 313p.

Progress in nuclear control is treated in elementary servo form and language. For descriptive and illustrative purposes on the design of control systems, the solid fuel heterogeneous reactor is used for a model but the basic techniques for the solution are presented in such a manner that the design of control systems for other types of reactor plants may be obtained by extension of the methods presented. (F.S.)

8673

POWER REMOVAL FROM BOILING NUCLEAR REACTORS. P. C. Zmola (Oak Ridge National Lab., Tenn.) and R. V. Bailey (Tulane Univ., New Orleans). Trans. Am. Soc. Mech. Engrs. 78, 881-92(1956) May.

The principal features of a nuclear reactor from which power is removed by boiling of the coolant within the active core are discussed. For most applications, the coolant is also the moderator and possibly the fuel carrier, and the objective is to devise a core arrangement which will permit operation at the highest power density for a given average fluid density. Calculations based on simple theoretical models are presented in performance-chart form to display the relation of influencing variables. Experimental results obtained from systems in which boiling was produced by electrical resistance heating of the liquid or simulated by bubbling air through the apparatus are summarized. A method for calculating the density distribution in a boiling system which takes into consideration explicitly the relative velocity of the vapor and liquid is presented. (auth)

8674

MINIMUM CRITICAL MASS AND FLAT FLUX. Gerald Goertzel (Nuclear Development Corp. of America, White Plains, N. Y.). J. Nuclear Energy 2, 193-201(1956) Mar.

The problem of distributing fuel in a homogeneous moderator region so as to obtain a reactor of minimum critical mass is set up, and a solution is obtained for thermal reactors. The condition for minimum critical mass is found to be constant thermal flux in the region where there is fuel (the core), with the thermal flux never greater than this constant value where there is no fuel (the reflector). It is necessary to solve an integral equation to find the fuel distribution. The size and shape of the core region is determined from this integral equation. An explicit solution is given for the multigroup reactor model. The minimum problem is also considered with certain restrictions, such as confining the core to a given region. Further, the minimum critical mass for U^{235} in light water is computed (with infinite reflector), and found to be 30% less than the corresponding best value for a uniform fuel distribution in the core. (auth)

8675

SOLUTION OF SOME NUCLEAR REACTOR PROBLEMS BY THE RESISTANCE-NETWORK ANALOGUE METHOD. I. ONE-VELOCITY-GROUP PROBLEMS. G. Liebmann (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 213-25(1956) Mar.

The known basic equations for core and reflector of a nuclear reactor are briefly discussed, and it is shown how the resistance-network analogue can solve these equations. Several specimen problems, involving either prescribed neutron flux at the boundaries or prescribed neutron currents, are then solved. The eigenvalues κ, determining the critical dimensions, are listed for these problems, and the neutron flux distributions are shown in graphical form. Finally, a problem determined by the total neutron current crossing the boundary $\int_S (\partial\rho/\partial n)d\sigma$ is solved, and the technique used for this is described in detail. (auth)

8676

EXPERIMENTAL REACTOR SYSTEMS. PART I. R. F. Jackson (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Eng. 1, 6-10(1956) Apr.

Exponential piles and zero energy reactors are logical steps in the development of high powered reactors enabling fundamental characteristics to be examined with the minimum cost and maximum safety. Details of a typical exponential experiment and critical assemblies are discussed with particular reference to the Harwell reactors. (auth)

8677

REACTORS AND POWER PRODUCTION AT MARCOULE. Nuclear Eng. 1, 22-4(1956) Apr.

The three reactors at Marcoule are now designed to generate electric power as well as produce plutonium. Details of the G1 and G2 piles with central entry cooling are given with a brief description of the plutonium-production plant. (auth)

8678

DOUNREAY FAST REACTOR MODEL. Nuclear Eng. 1, 34-5(1956) Apr.

The construction of accurate scale models assists not only in demonstrating a particular assembly but also in checking theoretical calculations. This model of the fast reactor at Dounreay shows the disposition of the primary heat exchangers and pumping circuits relative to the core. A brief description of the operation of the reactor is appended with some comments on the safety precautions. (auth)

8679

AN INTRODUCTION TO NUCLEAR ENERGY. J. M. Kay. Nuclear Eng. 1, 36-8(1956) Apr.

This introductory review gives a general outline of the basic principles of nuclear energy and includes a brief description of the more important types of reactors. (F.S.)

8680

THE WORLD'S REACTORS. NO. 1. BEPO. Nuclear Eng. 1, 14a-14b(1956) Apr. (This is No. 1 in a series of data sheets on various reactors available from Temple Press Ltd., Bowling Green Lane, London — Price: 4d.($0.10).)

Refer also to abstracts 8591 and 8592.

NUCLEAR TRANSFORMATION

8681 AERE-Lib/Trans-660

ASYMMETRY OF RANGES OF FRAGMENTS IN THE FISSION OF HEAVY NUCLEI BY VERY FAST PARTICLES. V. P. Shamov and O. V. Lozhkin. Translated by R. C. Murray from Doklady Akad. Nauk S.S.S.R. 103, 233(1955). 1p.

The fission of U, Bi, and W by 660-Mev protons was studied, and resultant conclusions are listed. (B.J.H.)

8682

INTERPRETATION OF THE Be^9(p,d) REACTION AT ENERGIES OF 5 TO 30 MEV. S. Glashow and W. Selove (Harvard Univ., Cambridge, Mass.). Phys. Rev. 102, 200-2(1956) Apr. 1.

The angular distribution of the Be^9(p,d) reaction is substantially constant between 5 and 30 Mev. The Butler theory, used with a finite radius as cutoff on the radial integral, does not give a satisfactory interpretation of this fact, but the "transparent-nucleus" Born approximation pick-up theory does. For incident energies between 16 and 31 Mev this theory gives a momentum distribution for the picked-up neutron which is consistently defined, and which agrees quantitatively with that obtained from the 95-Mev data; at lower energies, 5 to 8 Mev, the theory does not appear to work quite as well. The results of the analysis give support to the general validity of interpreting results of the high-energy pick-up process in terms of a momentum distribution and a single-particle model. (auth)

8683

NUCLEAR REACTIONS PRODUCED BY NITROGEN ON BORON AND OXYGEN. H. L. Reynolds, D. W. Scott, and A. Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. 102, 237-41(1956) Apr. 1.

The following nuclear reactions were detected from the bombardment of elemental boron and oxygen by energetic nitrogen ions: (1) $B^{10}(N^{14}, O^{15})Be^9$, (2) $B^{10}(N^{14}, N^{13})B^{11}$, (3) $B^{10}(N^{14}, C^{11})C^{13}$, (4) $B^{10}(N^{14}, F^{18})Li^6$, (5) $B^{11}(N^{14}, p)Na^{24}$, (6) $O^{16}(N^{14}, 2p)Al^{28}$, and (7) $O^{16}(N^{14}, F^{18})C^{12}$. The yields for these reactions were differentiated to obtain the cross sections as a function of energy. Reactions (2) and (3) can be identified as stripping reactions by comparison with similar proton-induced reactions and by comparison with previously studied nitrogen-induced reactions. Only a small part of reaction (1) seems to proceed through a stripping reaction although it should be similar to reaction (3). Reactions (1) and (4) are compared to proton-induced reactions in Na^{23} which lead to the same residual radioactive nuclei. The nitrogen-induced reactions are more probable by factors of 4 and 2, respectively, after barrier corrections, indicating that the nitrogen- and proton-induced reactions proceed through somewhat different mechanisms. The reactions observed in the bombardment of oxygen are compared to proton-induced reactions in Si^{29}. The (N^{14}, 2p) and (p, 2p) excitation functions may be similar but the lack of barrier penetration calculations prohibits accurate comparisons. (auth)

8684

TRITON-INDUCED REACTIONS. R. Sher and J. J. Floyd (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 102, 242(1956) Apr. 1.

By using tritons from pile-irradiated Li, the reactions $O^{18}(t,n)F^{20}$, $O^{18}(t,\alpha)N^{17}$, and $N^{15}(t,p)N^{17}$ have been observed, and their relative yields obtained. The cross section at about 2.7 Mev of the well-known reaction $O^{16}(t,n)F^{18}$ was also measured and is roughly 0.5 barn. (auth)

8685

IMPLICATIONS OF THE PHOTONUCLEAR EFFECT IN Zr^{90}. Peter Axel and John D. Fox (Univ. of Illinois, Urbana). Phys. Rev. 102, 400-14(1956) Apr. 15.

The reactions $Zr^{90}(\gamma,n)Zr^{89}$ and $Zr^{90}(\gamma,n)Zr^{89m}$ have been studied in detail. The threshold for $Zr^{90}(\gamma,n)Zr^{89m}$ is 12.37 ± 0.09 Mev; that for $Zr^{90}(\gamma,n)Zr^{89}$ is 11.78 ± 0.09 Mev. A discussion is given of the precision of (γ,n) threshold determinations and of the error sometimes introduced because of large spin differences. The detailed shape of the (γ,n) cross section is used to obtain data on both the absorption mechanism of gamma rays and the competition between the emission of neutrons and gamma rays by a compound nucleus. At about 12.4 Mev in Zr^{90}, less than 60% of the absorption occurs by the E1 process if E2 is the only other absorption process. If both M1 and E2 absorption occur equally, only about 10% of the absorption is E1. The competition between gamma ray and neutron emission could not be obtained quantitatively, but the results are consistent with other quite different measurements of this competition. (auth)

8686

STATISTICAL THEORY OF NUCLEAR FISSION: ASYMMETRIC FISSION. Peter Fong (Univ. of Chicago). Phys. Rev. 102, 434-48(1956) Apr. 15.

A statistical theory is developed, according to which the relative probability of a mode of fission is determined by the total excitation energy of its two fragments calculated at the moment just before separation. In order to calculate the excitation energy, the well known semiempirical atomic mass formula is corrected for its deviations known to be attributed to the effects of nuclear shells. The nuclear level density expression is studied empirically with special attention to shell effects. These results are used for a quantitative calculation of the relative probabilities of all possible modes of fission. The mass distribution curve of fission products of U^{235} induced by thermal neutrons is derived and compared with experimental results. Applications of the statistical theory to charge distribution, kinetic energy distribution, variations of mass, charge and energy distributions with respect to target nucleus and incident energy, prompt neutron distribution, spontaneous fission yields, and ternary fission will be discussed briefly. (auth)

8687

PROTON-INDUCED REACTIONS IN Na^{23}, Al^{27}, AND Si^{29}. Bernard L. Cohen (Oak Ridge National Lab., Tenn.). Phys. Rev. 102, 453-5(1956) Apr. 15.

Cross sections and excitation functions were measured for various reactions in Na^{23}, Al^{27}, and Si^{29} induced by 32-Mev protons from the Berkeley linear accelerator. These are compared with measurements by Reynolds and Zucker for reactions induced by 26-Mev N^{14} ions in B^{10}, N^{14}, and O^{16}; the same compound nuclei at the same excitation energies are involved. The N^{14}-induced reactions in which nearly equal-mass nuclei are emitted have much larger cross sections than the corresponding proton-induced reactions; this indicates that the former do not proceed by fission of a compound nucleus. Various spallation reactions were observed to have comparable cross sections in the two types of bombardments. (auth)

8688

YIELDS AND EXCITATION CURVES FOR THE HIGH-ENERGY PHOTOSPALLATION OF COBALT. Robert L. Wolke and Norman A. Bonner (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 102, 530-4(1956) Apr. 15.

Yields of several nuclides from the gamma-ray spallation of cobalt have been measured, using bremsstrahlung from the Cornell 300-Mev electron synchrotron. With 309-Mev bremsstrahlung, the yields are of the order of 1/200 times the (γ,n) cross section. A general decrease of yield with increasing number of ejected nucleons was found. Excitation curves for some of the reactions were determined from 174 to 309 Mev. The results indicate that the (γ,2pn) reaction is caused primarily by photons of energy less than 174 Mev,

while the (γ,2p5n), (γ,2p6n), and (γ,3p7n) reaction yields are contributed to by higher energy photons. The average "effective photon" energy is found to increase with increasing number of ejected nucleons. (auth)

8689

INTEGRAL (γ,α) YIELDS FOR HEAVY AND MEDIUM HEAVY ELEMENTS. F. Heinrich, H. Wäffler, and M. Walter. Helv. Phys. Acta 29, 3-36(1956) Mar. (In German)

Integral (γ,α)-yields due to 31 Mev-Bremsstrahlung are presented for V^{51}, Ge^{73}, In^{115}, Sb^{121}, Tl^{203}. The experimental ratios of the (γ,α)- to (γ,n)-yields have been determined for these nuclei. The same ratios are also computed from the statistical theory of nuclear reactions. They are in good agreement with the experiment. The differential excitation curves for the (γ,α)-reactions on Cu^{65}, Br^{81}, Rb^{87}, as measured by Haslam, Katz and others, and Ag^{109}, measured by de Laboulaye and Beydon have been calculated from the statistical theory. Here too the agreement between the experimental and theoretical curves is satisfactory. (auth)

8690

ISOTOPIC ENRICHMENT OF Br BY ELECTROLYTIC CONVERSION IN MOLTEN LEAD BROMIDE. A. E. Cameron, W. Herr, W. Herzog, and A. Lundén. Z. Naturforsch. 11a, 203-5(1956) Mar. (In German)

8691

STUDY OF THE $C^{12}(d,p)C^{13}$ AND $O^{16}(d,p)O^{17}$ REACTIONS. Fernando Alba A., T. A. Brody, Alonso Fernández, Marcos Mazari, Vinicio Serment, and Manuel Vásquez B. Rev. mex. fis. 4, 207-23(1955) Oct. (In Spanish)

Angular distributions of (d,p) reactions in O and C at energies between 1 and 2 Mev are obtained, and in some cases are found to differ widely from Butler's theory of resonance energies. (auth)

8692

STUDY OF HIGH ENERGY INTERACTIONS PRODUCED IN PHOTOGRAPHIC EMULSION. J. Combe (Laboratoire de Physique Corpusculaire de l'Universite, Strasbourg). Nuovo cimento (10) 3, Suppl. No. 2, 182-234(1956). (In French)

A detailed review is given of high-energy interactions in photographic emulsions. Included are discussions of the nuclear models used, the Monte-Carlo method of analyzing the data, and the results and their significance. (B.J.H.)

8693

FISSION OF URANIUM WITH 170 MEV PROTONS. Arve Kjelberg and Alexis C. Pappas (CERN, Copenhagen, Denmark and Gustaf Werner Inst. for Nuclear Chemistry, Uppsala, Sweden). Nuclear Phys. 1, 322-5(1956) Apr.

The formation cross section of 22 products formed in fission and spallation of natural U with 170-Mev protons have been measured. The integrated fission cross section is determined to (1.9 ± 0.3) barn. Improved half lives are reported for Sr^{89} and Ni^{66}, respectively (51 ± 1)d and (54 ± 0.3)h. The energy of the β particles from Ni^{66} is determined to 0.15 Mev. (auth)

Refer also to abstract 8533.

PARTICLE ACCELERATORS

8694 MURA-IO-6

Illinois. Univ., Urbana. and Midwestern Universities Research Assn., Urbana, Ill.

A SCALED RADIAL SECTOR FFAG FOR INTERSECTING BEAMS. Tihiro Ohkawa. July 9, 1956. 4p. $1.80(ph OTS); $1.80(mf OTS).

A scaled radial sector FFAG for intersecting beams is proposed. To accomodate both beams which proceed in opposite directions the magnetic field averaged in azimuthal direction is zero. Scalloped orbits are used. (F.S.)

8695 MURA-NVN-4

Midwestern Universities Research Assn., Urbana, Ill. and Illinois. Univ., Urbana.

A SHORT SURVEY OF DIGITAL COMPUTER RESULTS FOR RADIAL MOTION IN F.F.A.G. MARK V SPIRAL RIDGE ACCELERATORS. Nils Vogt-Nilsen. June 1956. 18p.

General remarks are made pertaining to the graphical presentation and interpretation of numerical computations on non-linear one dimensional motion. A survey of numerical results is then given for the radial motion on the median plane in a set of large-scale FFAG Mark V spiral ridge accelerators. (auth)

8696

ATTAINMENT OF VERY HIGH ENERGY BY MEANS OF INTERSECTING BEAMS OF PARTICLES. D. W. Kerst, F. T. Cole, H. R. Crane, L. W. Jones, L. J. Laslett, T. Ohkawa, A. M. Sessler, K. R. Symon, K. M. Terwilliger, and Nils Vogt Nilsen (Univ. of Illinois, Champaign). Phys. Rev. 102, 590-1(1956) Apr. 15.

It is suggested that fixed-field alternating-gradient accelerators offer the possibility of obtaining sufficiently intense beams so that it would be reasonable to consider directing two beams of approximately equal energy at each other. Thus two 21.6-Bev accelerators would be equivalent to one 1,000-Bev accelerator. Possible experimental arrangements and multiple scattering problems are briefly discussed. (B.J.H.)

8697

AN APPARATUS FOR THE ACCURATE CONTROL OF THE PEAK X-RAY ENERGY OF A 20 MEV BETATRON. K. Phillips (Metropolitan-Vickers Electrical Co., Ltd., Manchester, England). Brit. J. Appl. Phys. 7, 129-36(1956) Apr.

Two methods on the accurate control of the electron energy of a 20 Mev betatron are described in detail. In one method a current transformer supplies a reference voltage in phase with the current in the betatron magnet coils to a trigger and potentiometer control unit. The second method uses a peaking transformer which is connected in series with the betatron magnet coils and supplies a pulse to a differentiating amplifier. The time of firing of the peaking transformer during the acceleration cycle is controlled by means of a high-current, low-voltage stabilizer. The same trigger circuit and expander modulator are used in both methods. A detailed comparison of the performance of the two methods is made and their advantages and limitations are discussed. (auth)

RADIATION ABSORPTION AND SCATTERING

8698 AERE-RP/M-67

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME OBSERVATIONS ON γ-RAY SCATTERING ROUND A SHADOW SHIELD IN WATER. C. C. Horton, J. R. Harrison, A. M. Mills, and M. A. Hone. Nov. 29, 1955. 8p.

The γ-ray shield for the neutron flux ionization chambers used in the control of the Shielding Reactor consists of a shadow shield of 4-in. thickness. It is shown that to remove effects due to backscattering of γ radiation in the water, a shield $\frac{1}{8}$-in. thick is needed at the rear of the chambers. (auth)

8699

ENERGY SPECTRUM OF ELECTRONS PRODUCED IN

ALUMINUM BY 17.8-MEV BREMSSTRAHLUNG. Robert L. Stearns and E. C. Gregg (Case Inst. of Tech., Cleveland, Ohio). Phys. Rev. 102, 1-4(1956) Apr. 1.

A 60° magnetic spectrometer is used to obtain a relative measurement of the integrated energy spectrum of secondary electrons produced at depths of one-half inch and four inches in aluminum by 17.8-Mev bremsstrahlung. The experimental spectra were found to agree with theoretical spectra calculated by the method due to Brysk to within the experimental error of 5%. (auth)

8700

SCATTERING OF 22-MEV POSITIVE PIONS BY PROTONS. Stanley L. Whetstone, Jr. and Donald H. Stork (Univ. of California, Berkeley). Phys. Rev. 102, 251-61(1956) Apr. 1.

The differential cross section for the reaction $\pi^+ + p \rightarrow \pi^+ + p$ was measured in the angular interval 45° to 135° in the center-of-mass system at a pion energy of 21.5 ± 3.5 Mev in the laboratory system. The pion beam was formed by a magnetic-focusing selection of pions produced from polyethylene at an angle of 0° in the reaction $p + p \rightarrow \pi^+ + d$. The production target was placed in the strong-focused 340-Mev proton beam electrostatically deflected from the Berkeley synchrocyclotron. The pion beam entered liquid hydrogen contained in a Styrofoam scattering target at 25.0 Mev, with an energy spread of ± 0.6 Mev, and left at 18.0 Mev. Scattered pions were detected in an emulsion stack placed 1 inch from the beam edge and $\frac{7}{8}$ inch from the liquid hydrogen. The data, consisting of 41 acceptable events, were analyzed by a maximum-likelihood method to obtain the following best values for the pion-proton scattering phase shifts at a relative momentum, $\eta = 0.49$: $\alpha_3 = -0.048 \pm 0.007$, $\alpha_{33} = +0.013 \pm 0.013$, $\alpha_{31} = 0.000 \pm 0.016$. (auth)

8701

DIFFERENTIAL INELASTIC SCATTERING OF RELATIVISTIC CHARGED PARTICLES. U. Fano (National Bureau of Standards, Washington). Phys. Rev. 102, 385-7(1956) Apr. 15.

The angular distribution of inelastic scattering, given by the Møller-Bethe formulas, is presented explicitly and analyzed in terms of longitudinal and transverse interactions which are incoherent because of different parity. Its connection with the Čerenkov radiation and its conceivable experimental observation are indicated. (auth)

8702

GAMMA RADIATION FROM INELASTIC SCATTERING OF FAST NEUTRONS BY ISOTOPES OF TELLURIUM, NICKEL, AND COPPER. Rolf M. Sinclair (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 102, 461-4(1956) Apr. 15.

Gamma radiation from 4.4 ± 0.1-Mev neutron bombardment of separated isotopes was observed with a single crystal NaI(Tl) spectrometer. Gamma rays assigned to inelastic scattering are (energies in Mev): Te^{126}, 0.68 ± 0.02, 1.38 ± 0.04; Te^{128}, 0.76 ± 0.02; Te^{130}, 0.83 ± 0.02; Ni^{58}, 1.01 ± 0.01, 1.46 ± 0.02; Cu^{63}, 0.65 ± 0.01, 0.97 ± 0.01, 1.34 ± 0.03, 1.43 ± 0.05; Cu^{65}, 1.12 ± 0.02. A 1.35 ± 0.02 Mev γ ray is assigned to Ni^{60} by elimination. Relative yields of the gamma rays are given and their assignment to various excited states of the target nuclei is discussed. (auth)

8703

ELASTIC SCATTERING OF 340-MEV PROTONS BY DEUTERONS. Owen Chamberlain and David D. Clark (Univ. of California, Berkeley). Phys. Rev. 102, 473-85(1956) Apr. 15.

The differential cross section for the elastic scattering of 340-Mev protons by deuterons has been measured at eight angles from 30° to 150° in the center-of-mass system. A coincidence counting system using scintillation counters detected both product particles, the elastic effect being separated from the inelastic through identification of the scattered deuterons by photographically recorded pulse heights produced in a counter telescope. The resulting cross section is, at 30°, 2.2 mb/steradian; 40°, 0.89; 50°, 0.39; 70°, 0.11; 90°, 0.047; 110°, 0.042; 130°, 0.047; and 150°, 0.099, in center-of-mass units. The total (statistical and systematic) errors range from 15 to 24%. The total elastic cross section is estimated to be 6.0 + 1.2 mb. Problems of interpretation using the impulse approximation are discussed; the sticking factor is calculated for three different n-p potentials. At scattering angles of 30° and 40° there appears to be very little interference effect between n-p and p-p scattering. The interference is perhaps slightly destructive. (auth)

8704

POTENTIAL SCATTERING OF HIGH-ENERGY ELECTRONS IN SECOND BORN APPROXIMATION. R. R. Lewis, Jr. (Univ. of Notre Dame, Ind.). Phys. Rev. 102, 537-43(1956) Apr. 15.

Formulas are derived for the scattering cross section of a high-energy electron in a static potential, correct to second order in the potential, in terms of certain integrals. The potential is that due to a screened, spherical charge distribution. The integrals are evaluated explicitly for Yukawa, exponential and Gaussian charge distributions, and are expanded in power series in k and 1/k for an arbitrary charge distribution. Numerical results are presented. (auth)

8705

SCATTERING OF ELECTRONS FROM NUCLEAR CHARGE FLUCTUATIONS. R. R. Lewis, Jr. (Univ. of Notre Dame, Ind.). Phys. Rev. 102, 544-9(1956) Apr. 15.

An attempt is made to discuss the influence of non-potential-scattering effects in the elastic scattering of electrons from nuclei. It is shown that in the second order of perturbation theory, if we assume the major contributions to come from low-lying nuclear states, the scattering is completely determined by specifying the average charge density of the ground state, and the density of the fluctuations about this charge distribution. Numerical computations are presented for one simplified model of these distributions. (auth)

8706

DETERMINATION OF THE POTENTIAL FROM SCATTERING DATA. Joseph B. Keller, Irvin Kay, and Jerry Shmoys (New York Univ.). Phys. Rev. 102, 557-9(1956) Apr. 15.

It is shown that in classical mechanics a spherically symmetric repulsive potential can be determined from the differential scattering cross section for particles of a single energy E. The potential is determined explicitly, but only outside the radius of closest approach at energy E. Higher energies are required to probe closer to the center. The results are compared with related quantum-mechanical results. (auth)

8707

POLARIZATION EFFECTS IN NEUTRON-PROTON SCATTERING AT 98 MEV. P. Hillman and G. H. Stafford (Atomic Energy Research Establishment, Harwell, Berks, England). Nuovo cimento (10) 3, 633-41(1956) Mar.

The polarization in free neutron-proton scattering has been measured at 98 ± 3 Mev as a function of scattering angle. A maximum asymmetry e = 4% corresponding to a polarization of 39% is indicated. The angular distribution departs strongly from anti-symmetry about 90° c.m. angle. (auth)

8708

ON THE IONIZATION-ENERGY RELATION FOR ALPHA-PARTICLES IN AIR. Ryutaro Ishiwari, Sukeaki Yamashita,

Kazunori Yuasa, and Kozo Miyake (Univ. of Kyoto, Japan). J. Phys. Soc. Japan 11, 337-47(1956) Apr.

To investigate the effect of columnar recombination on the ionization measurement in air, the ratio of the specific ionizations at two fixed residual ranges for Po α particles was measured with a shallow ionization chamber under various field strengths and angles between the field and the α track. It was found that the observed ratio varies appreciably with varying field strength and angle. It was shown that the observed variation of the ratio can be explained by the effect of columnar recombination and agrees qualitatively with Jaffé's theory. The value of the parameter b in Jaffé's formula, which gives the best agreement with the experiments, was newly determined as 9.5×10^{-4} for α particles in atmospheric air. The observed specific ionization curve was corrected for recombination by Jaffé's theory. Then, the corrected curve was integrated and the true ionization-range relation free from recombination was determined. By comparing this relation with the fixed points of the range-energy relation obtained from nuclear reaction data, an empirical formula for the average energy loss per ion pair for α particles in air relative to Po α particles, w, was obtained as; $w = 0.948 + 0.119/\sqrt{E}$, where E is the initial α energy in Mev. This formula is valid at least for the α energy down to 1 Mev. (auth)

8709

THE MULTIPLE SCATTERING OF FAST ELECTRONS. Seizaburo Kageyama (Tokyo Univ. of Education). J. Phys. Soc. Japan 11, 348-51(1956) Apr.

The angular distribution, caused by the multiple scattering, of 1.66-Mev electrons passing through thin foils of Al, Cu and Pb, has been investigated. The experimental results were in good agreement with Moliere's theory modified by Hanson et al. on the basis of their experimental data. The theoretical 1/e width values given by Shinohara were also in good agreement with those observed in light elements, but they seem to be slightly larger in heavy elements. (auth)

Refer also to abstract 8569.

RADIATION EFFECTS

8710 AD-82829

Admiral Corp., Chicago.

THE EFFECTS OF NUCLEAR RADIATION ON ELECTRONIC COMPONENTS. Scientific Report No. 2. R. D. Shelton, ed. Jan. 1, 1956. 95p. Contract AF33(616)-3091.

During this period several major improvements were made in the method of testing and instrumentation, in addition to the irradiation of selected electronic components. Integrated thermal fluxes were monitored by inserting small Co wires with the components being tested. The cobalt wires were then calibrated by comparison with irradiated gold foils. During this period a group of polyethylene-insulated wires was compared to a similar group of conductors using polyvinyl-chloride as the insulator. These were compared in a test designed to maximize any leakage effects present. The result of this test showed the polyethylene insulation to be superior as an insulator material while undergoing irradiation in the reactor. Tests were made on full-sized sample quantities of types 6AK5 and 1AD4 vacuum tubes, with the result that these tube types were able, in general, to operate throughout the irradiation period of the tests without failure. A group of electrolytic capacitors was tested. They were found to fail after approximately 1.4×10^{17} NVT by becoming short-circuited. A single type 5U4G rectifier tube was placed in the reactor and connected to an external power supply in such a way that it operated in normal rectifier service, under full load conditions. This tube operated throughout the test run without a significant change in its operation. A group of four oil-impregnated paper capacitors was tested without showing signs of failure. (For preceding period see AD-77763.) (auth)

8711 NAA-SR-1580

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THRESHOLD DISPLACEMENT ENERGY IN NICKEL. H. M. Kenworthy and H. H. Neely. Aug. 1, 1956. 19p. Contract AT-11-1-GEN-8. $0.25(OTS).

Nickel foils, 10,000 A thick, were irradiated at 4.2°K with a variable energy electron beam. The threshold displacement energy in nickel was determined by measuring the minimum energy of the electrons required to produce an increase in electrical resistivity. The electron energy threshold was found to be 0.59 ± 0.01 Mev; this corresponds to a threshold displacement energy in nickel of 34.5 ± 1 ev at 4.2°K. Preliminary annealing data were obtained by heating the specimen from 4.2 to 373°K. Recovery states were found at approximately 30 and 280°K. (auth)

8712 WAPD-SFR-Fe-303

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

IMPACT RESULTS ON IRRADIATED STAINLESS STEEL CONTAINING B^{10}. J. R. Schettig. Oct. 20, 1955. 6p.

Bound with this report with separate pagination is WAPD-SFR-Fe-333. TENSILE RESULTS ON IRRADIATED STAINLESS STEEL CONTAINING B^{10}. Supplement to WAPD-SFR-Fe-303. J. R. Schettig. Nov. 18, 1955. 3p.

Samples of stainless steel, B^{10}—stainless steel alloys, and Hf were irradiated in the MTR and impact tested. Test results are tabulated. The impact strength of B^{10}—stainless steel alloys appear to vary inversely with B^{10} content. (D.E.B.)

8713 WAPD-T-206

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

EFFECTS OF NEUTRON BOMBARDMENT UPON THE PROPERTIES OF ASTM TYPE SA212B STEEL. M. L. Bleiberg. Oct. 12, 1955. Decl. Dec. 2, 1955. 48p. Contract AT-11-1-GEN-14. $0.35(OTS).

An investigation studying the effects of neutron bombardment on the impact energy to fracture, hardness, and electrical resistivity of an 0.29% C boiler plate steel (ASTM Type SA212B), and the special equipment and different experimental techniques used in this investigation are described. An attempt was made to interpret the results of this investigation in light of the proposed models of radiation damage. (auth)

8714

ANNEALING OF IRRADIATION EFFECTS IN SODIUM CHLORIDE IRRADIATED WITH HIGH ENERGY PROTONS. Koichi Kobayashi (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 102, 348-55(1956) Apr. 15.

Single crystals of sodium chloride were subjected to irradiation at room temperature by 350-Mev protons with a total flux of 10^{12} to 10^{16} protons per cm^2, and changes in their electrical conductivity, stored energy, and optical absorption were studied. The relative resistivity changes due to irradiation were measured during warmup at a rate of 2°C/min, showing maxima at around 150°C and 250°C and annealing out at about 400°C. The stored energies released during annealing were measured in the same temperature range. The results indicate the presence of three stages of annealing, the first lies between room temperature and 150°C, the second between 150°C and 250°C and the third is above 250°C. The stored energy curve has maxima at 100°C, 200°C, and 310°C. The probable mechanisms of the various annealing processes are discussed. In particular specific

mechanisms are proposed for the second stage of the annealing in which significant changes of the optical absorption bands take place. Efficiency of the production of defects was estimated to be the order of 10^3 per proton per centimeter path, and this is compared briefly with the theories of Seitz and Smoluchowski. (auth)

RADIOACTIVITY

8715 IGO-AM/W-39

Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE PREPARATION OF STANDARDS FOR THE DETERMINATION OF α AND β ACTIVITIES OF GRANULAR SAMPLES. Celia J. Banks and O. Jones. June 12, 1956. 4p.

8716 ISC-648

Ames Lab., Ames, Iowa.
BETA SPECTRA OF SOME SHORT-LIVED NUCLIDES. Laurence S. Ring, Jr. and D. J. Zaffarano. June 1955. 51p. Contract W-7405-eng-82. $0.35(OTS).

Endpoint kinetic energies, half-lives, and ft values are tabulated for Si^{27}, P^{29}, S^{31}, and Ca^{39}. A modified beta scintillation spectrometer is described. (C.W.H.)

8717

RADIATIONS OF PLUTONIUM-246. D. C. Hoffman and C. I. Browne (Los Alamos Scientific Lab., N. Mex.). J. Inorg. and Nuclear Chem. 2, 209-18(1956) Apr.

The β and γ spectra of Pu^{246} were examined with scintillation spectrometers used in conjunction with multichannel analyzers and a coincidence circuit. A decay scheme is presented and the disintegration energy is given as 0.400 ± 0.030 Mev. (auth)

8718

ON THE HIGH ENERGY GAMMA-TRANSITIONS OF W^{182}. Gunnar Bäckström. Arkiv Fysik 10, No. 4, 387-91(1956).

An iron-pole double-focusing spectrometer was used to study the high-energy γ transitions in W^{182}. The sample was produced by an (n,γ) reaction in the Harwell reactor. Results are tabulated, and the decay scheme is shown. (B.J.H.)

8719

ON THE ENERGY OF THE 570 KEV γ-RAY OF Bi^{207}. Gunnar Bäckstrom. Arkiv Fysik 10, No. 4, 393-5(1956).

A large, double-focusing β spectrometer was used to study the γ radiation from Bi^{207}. The resultant decay scheme is shown. (B.J.H.)

8720

RADIATIONS FROM ^{178}W. A. Bisi, S. Terrani, and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan). Nuovo cimento (10) 3, 661(1956) Mar.

A hafnium oxide target was irradiated in the Amsterdam cyclotron with 52-Mev α particles. Tungsten carrier was added to the irradiated sample and then was extracted. The activity of the W fraction was studied, and results show a complex decay curve with half lives of 22.0 ± 0.5 and 145 ± 5 days. (B.J.H.)

8721

^{160}Tb DECAY. G. Bertolini, M. Bettoni, and E. Lazzarini (Istituto di Fisica Sperimentale del Politecnico, Milan). Nuovo cimento (10) 3, 754-63(1956) Apr.

By means of an intermediate β spectrometer and a scintillation spectrometer, the decay of Tb^{160} has been studied. Coincidences between β^- continuous spectrum and selected γ-rays allows the resolution of the low energy β^- spectra. β^- rays of 367 ± 12, 564 ± 6.5, 861 ± 1.8, and 1711 ± 7 kev have been resolved. From their photospectra relative intensities of γ-rays have been taken. Conversion coefficients of some γ-rays have been obtained. A decay scheme is suggested. The possibility of the rotational character of some of the excited levels, predicted by the Bohr-Mottelson theory, is discussed. (auth)

8722

EXTINCT NATURAL RADIOACTIVITY: POSSIBILITIES AND POTENTIALITIES. Truman P. Kohman (Carnegie Inst. of Tech., Pittsburgh). Ann. N. Y. Acad. Sci. 62, 503-42(1956) Apr. 13.

An experimental program in search of extinct natural radionuclides is attempting to produce long-lived nuclides by artificial means and then to detect their decay products in terrestrial and meteoritic minerals. (F.S.)

8723

TIME-DEPENDENT DIRECTIONAL CORRELATION OF 1.1-HR Pb^{204}. G. K. Wertheim and R. V. Pound (Harvard Univ., Cambridge, Mass.). Phys. Rev. 102, 185-9(1956) Apr. 1.

A study is made of an effect attributable to the interaction of the electric quadrupole moment of the 0.27-μsec level of Pb^{204} with the crystalline electric field in metallic, polycrystalline thallium in which 68-min Pb^{204} is produced by (p,2n) reaction. The directional anisotropy in the rate of delayed coincidences between the γ ray preceding the 0.27 μsec state and the γ rays following the state is observed as a function of the delay time. Although some discrepancy between the observed function and theory is found, the time dependence suggests a coupling frequency $eQ(\partial^2V/\partial z^2)/h$ of 12 Mc/sec. Measurements of the directional correlation between the two gamma rays in prompt coincidence following the 0.27μsec state supports the assignment, by Krohn and Raboy, of spin 4 to that state and of some mixing of M3 with the dominantly E2, 371-kev gamma ray. Evidence of prompt γ rays of several energies, following K-capture in 12-hr Bi^{204}, is also found. (auth)

8724

DECAY SCHEME OF Au^{194}. M. T. Thieme and E. Bleuler (Purdue Univ., Lafayette, Ind.). Phys. Rev. 102, 195-9 (1956) Apr. 1.

The radiations of the 40-hr Au^{194} were investigated with a scintillation and a magnetic lens spectrometer, using coincidence techniques. First forbidden positron transitions with endpoints of 1.55 ± 0.02 and 1.21 ± 0.02 Mev were found to lead to the ground state and the first excited state of Pt^{194}. Most of the transitions and levels of Pt^{194} known from the decay of Ir^{194} were confirmed. Additional gamma rays of ~950, 1590 ± 20, 1890 ± 20, and 2150 ± 15 kev were observed, indicating new levels at 2150 and 2215 kev. (auth)

8725

DECAY OF Rb^{89}. G. D. O'Kelley, N. H. Lazar, and E. Eichler (Oak Ridge National Lab., Tenn.). Phys. Rev. 102, 223-7(1956) Apr. 1.

Sources of Rb^{89} were prepared from the decay of fission product Kr^{89} and studied by scintillation methods. The half-life was found to be 14.9 ± 0.3 minutes. Gamma rays of energy 0.663 ± 0.006, 1.05 ± 0.02, 1.26 ± 0.01, 1.55 ± 0.03, 2.20 ± 0.02, 2.59 ± 0.03, 2.75 ± 0.05, and 3.52 ± 0.07 Mev and relative intensity 0.217 ± 0.026, 1.00, 0.717 ± 0.090, 0.048 ± 0.010, 0.190 ± 0.025, 0.169 ± 0.031, 0.037 ± 0.007, and 0.029 ± 0.005 were measured. Gamma-gamma coincidence with a surrounding solution phosphor tank, establish a decay scheme with levels in Sr^{89} at 1.05, 2.31, 2.59, 2.75, 3.25, and 3.52 Mev. The ground-state beta-ray transition was measured as 3.92 ± 0.05 Mev, and is present in about 7% of the beta-ray transitions. (auth)

8726

RECOIL PARTICLES FROM Po^{210} AND THEIR IONIZATION IN ARGON AND HELIUM. William P. Jesse and John Sadauskis (Argonne National Lab., Lemont, Ill.). Phys. Rev. 102, 389-90(1956) Apr. 15.

The average energy W_r to make an ion pair for the recoil particles ejected by the disintegration of Po^{210} has been measured in argon and helium by a modification of a very old method. The ratio of this value for the recoil particles to the corresponding W_α value for the Po^{210} alpha particles was found to be 4.1 and 4.5 in helium and argon, respectively. The ratio for argon is in good agreement with an earlier determination by Madsen for an argon-air mixture. The maximum radial distance traversed by the recoil particles was found to be 7.7×10^{-3} cm and 52×10^{-3} cm in argon and helium, respectively, under standard conditions. (auth)

8727

POSITRONS FROM THE DECAY OF P^{32} AND Y^{90}. Jack S. Greenberg and Martin Deutsch (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 102, 415-21(1956) Apr. 15.

A magnetic focusing arrangement is combined with coincidence counting of the annihilation radiation to permit detection of very low positron intensities in the presence of other radiations. Sources of P^{32} yielded $(7.5 \pm 2) \times 10^{-10}$ positrons per beta decay. An experiment with a gold-covered source showed that secondary effects in the source material may contribute an important fraction of these positrons. One may conclude that the number of positrons per beta decay of P^{32} does not exceed by more than a factor of two the value 5.5×10^{-10} expected theoretically from electromagnetic effects and is probably close to the theoretical value. Sources of Y^{90} emit $(3.6 \pm 0.9) \times 10^{-5}$ positrons per beta decay, due primarily to the 1.75-Mev electric monopole transition in Zr^{90}. (auth)

8728

INTERNAL PAIR CREATION IN BETA DECAY. Kerson Huang (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 102, 422-6(1956) Apr. 15.

A physical picture is presented for internal pair creation in beta decay, and the ratio of the total number of positrons to the total number of electrons emitted is calculated for the transition $P^{32} \rightarrow S^{32}$. The result is in agreement with the experiment of Greenberg and Deutsch. (auth)

8729

DECAY OF THE NEW NUCLIDE Ne^{24}. B. J. Dropesky and A. W. Schardt (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 102, 426-33(1956) Apr. 15.

The nuclide Ne^{24} has been produced by bombarding a neon gas target with 1.5-Mev tritons, the reaction being $Ne^{22}(t,p)Ne^{24}$. Beta and gamma scintillation spectrometers with coincidence circuits were used to study this nuclide. Ne^{24} decays with a half-life of 3.38 ± 0.02 min, emitting negative beta groups of 1.98 ± 0.05 and 1.10 ± 0.05 Mev. This decay is also accompanied by gamma rays of 472 ± 5 and 878 ± 9 kev with relative intensities of 100 to 8, respectively. The excited levels in Na^{24} corresponding to the above transitions are at 0.472 and 1.35 Mev. The 0.472-Mev level is an isomeric state with a half-life of the order of 20 milliseconds. The spins and parities of the Na^{24} ground state, 0.472-Mev, and 1.35-Mev levels are 4+, 1+, and 1+, respectively. The $Ne^{24}-Na^{24}$ energy difference is 2.449 ± 0.035 Mev, and the Ne^{24} mass is 24.001195 ± 0.000040 atomic mass units. (auth)

8730

DECAY OF Ca^{49} AND Sc^{49}. D. W. Martin, J. M. Cork, and S. B. Burson (Argonne National Lab., Lemont, Ill.). Phys. Rev. 102, 457-8(1956) Apr. 15.

Ca^{49} has been found to decay with a half-life of 8.9 ± 0.2 minutes. It emits two principal beta components of energies 2.12 ± 0.10 and about 1.0 Mev in coincidence, respectively, with gamma rays of 3.07 ± 0.05 and 4.04 ± 0.06 Mev. The intensity ratio of these two branches is 8.5:1. The intensity of a possible ground-state beta branch is less than 1%, and that of a possible 0.98-Mev gamma transition between the 3.07- and 4.04-Mev levels is less than 3%. These data indicate that these excited states are respectively the single-particle $p_{3/2}$ and $f_{5/2}$ levels available for excitation of the twenty-first proton in Sc^{49}. Sc^{49} is found to emit in turn a single beta component of energy 1.80 ± 0.10 Mev. (auth)

8731

DECAY OF Rn^{220} AND Rn^{222}. L. Madansky and F. Rasetti (Johns Hopkins Univ., Baltimore). Phys. Rev. 102, 464-5(1956) Apr. 15.

A gamma ray of energy 510 ± 2 kev and approximate intensity 7×10^{-4} quanta per decay is emitted in the alpha decay of Rn^{222}. A gamma ray of energy 542 ± 2 kev and approximate intensity 2.5×10^{-4} quanta per decay is emitted in the alpha decay of Rn^{220}. The intensities are considered accurate only to within a factor of two. (auth)

8732

INNER BREMSSTRAHLUNG EMITTED IN ELECTRON CAPTURE DECAY OF Ni^{59}, A^{37}, AND Fe^{55}. Babulal Saraf (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 102, 466-73(1956) Apr. 15.

The continuous gamma-ray spectra (inner bremsstrahlung) accompanying orbital electron capture in Ni^{59}, A^{37}, and Fe^{55} have been studied with the use of a scintillation spectrometer of NaI(Tl). The shape of the spectrum of Ni^{59} has been found to correspond to a second forbidden spectrum ($\Delta I = 2$, No) and is distinctly different from that of an allowed one. The parameter, λ, of the correction factor, $C_{2s,T}$, is approximately 0.33; the value of A_{ij}/T_{ij}, for a pure tensor interaction, is (−6). The probability of emission of a photon of energy greater than 100 kev has been shown to be 1.4 ± 0.4 times the theoretical value. The spectrum of A^{37} has an allowed shape at energies as low as ~35 kev, and the ratio of emission probabilities $P_{(exp)}/P_{(theoret)}$ is 1.05 ± 0.25 for the region of energy lying above 35 kev. The spectrum of Fe^{55} has been compared with the calculations of Glauber and Martin. In this case, the value of $P_{(exp)}/P_{(theoret)}$ is 1.1 ± 0.3 at higher energies. (auth)

8733

THE CONTINUOUS BETA SPECTRUM OF RaC. H. Daniel and R. Nierhaus. Z. Naturforsch. 11a, 212-15(1956) Mar. (In German)

The beta spectrum of RaC was detected by a magnetic double lens spectrometer and is separated in groups of 3.26 ± 0.03 Mev (19%), 1.88 ± 0.08 Mev (9%), 1.51 ± 0.05 Mev (40%), 1.02 ± 0.12 Mev (23%), 0.42 ± 0.15 Mev (9%). (tr-auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

8734

DISSOCIATION ENERGY OF GASEOUS LaO. William A. Chupka, Mark G. Inghram, and Richard F. Porter (Univ. of Chicago and Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 24, 792-6(1956) Apr.

The gaseous species in thermodynamic equilibrium with $La(l)-La_2O_3(s)$ mixtures in the temperature range 1650 to 1900°K have been studied mass spectrometrically. The major ions observed were La^+ and LaO^+. These ions were shown to be formed predominantly from La(g) and LaO(g), respectively. A thermodynamic treatment of ion currents yields a value of $\Delta H_0^0 = 100 \pm 4$ kcal/g atom for the heat of vaporization of La(s) and a value of $\Delta H_0^0 = 189 \pm 8$ kcal mol for the reaction $LaO(g) = La(g) + O(g)$ or $D_0(LaO) = 8.15 \pm 0.35$ ev. (auth)

SHIELDING

Refer to abstract 8698.

SPECTROSCOPY

8735 NP-6057

Columbia Univ., New York. Columbia Radiation Lab.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Quarterly Progress Report No. 2 [for] March 16, 1956 through June 15, 1956. P. Kusch. June 15, 1956. 44p. DA Project 3-99-10-022. Contract DA-36-039-SC-64630. (CU-4-56-SC-64630-Phys.)

Several harmonic generator magnetrons were constructed and tested. The maximum harmonic power was 3.7 kw and best harmonic efficiency was 1.1%. A tuning range of 11.9% has been obtained for a TRV3 magnetron operating at a single fixed magnetic field. Over this tuning range the output power exceeded 5 watts and the efficiency exceeded 3%. The mechanical tuning range of this tube is 15.7%. The electronic apparatus for the generation of mm waves has been completed and tests using a trial tungsten filament in the electron gun are to be initiated. The signal from the second cavity of the two-cavity system of the Maser has been observed to be too weak and improvements of the system are in progress. The system for investigating beam collimation using a Pirani gauge as a detector is now completely assembled. A high sensitivity of the detector has been observed. A search was made for exceptional generators which deliver more fourth harmonic power at one watt input power than at 0.4 watts. Occasional generators of this type were found, but they delivered at most only 50% more harmonic power than can be obtained at 0.4 watts input. A ferrite isolator for 1.4 cm wavelength has been completed and tested. Antiferromagnetic resonance has been observed in a single crystal of MnF_2 at several frequencies near 100 kMc at temperatures near 60°K. From these data both the Neel temperature and $(2H_EH_A)^{\frac{1}{2}}$ have been calculated. A further improvement was found in the ratio of the absorptions in the superconducting and normal states when all joints in the specimen were soldered vacuum tight. This ratio is now 1/7, but should be four or five times smaller. A new Zeeman modulated microwave absorption cell with good microwave transmission between 10 and 40 kMc is being used to search for the NH radical. A cell for measurement of the OH electrical dipole moment is being built. The limitation of the signal to noise ratio of the thallium resonance and its line widths have prevented a successful observation of this resonance. It is believed that the primary source of difficulty at the present is the spectral width of the rf source which needs to be better than a part in 3×10^8. To achieve this, stabilization of the klystron against the ammonia Maser is being set up. An excitation curve has been obtained for production of metastable helium ions by electron bombardment. (auth)

8736 ORNL-2114

Oak Ridge National Lab., Tenn.
STABLE ISOTOPES DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING MAY 20, 1956. Aug. 14, 1956. 60p. Contract W-7405-eng-26. $0.40(OTS).

Infrared spectra for TCN, $Ca(OH)_2$, Li_3N, and Po are reported. A Doppler effect was observed in the spectra of ions excited in the calutron J arc. The x-ray fluorimetric determination of Y in uranium solutions is outlined. Metastable and collision-induced transitions in the mass spectra of n-butane and i-butane were studied. A method is presented for estimating the ion beam width in a mass spectrometer. Procedures are briefly described for the isolation from calutron targets and subsequent purification of Mo, Br_2, Sr, Mg, Ag, and Sm. The distribution of rare earths between TBP and HNO_3 was investigated. Tungsten, Ge, Zn, and Ti irradiation targets were prepared. (For preceding period see ORNL-2028.) (C.W.H.)

8737 WADC-TR-55-108

Spectrochemical Labs., Inc., Pittsburgh.
THE EMISSION SPECTROGRAPHIC ANALYSES OF TITANIUM METALS AND ALLOYS. [Period covered] January 1, 1954 to May 31, 1955. E. M. DuBois, Arno Tuteur, and J. L. Mahan. Aug. 1955. 99p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: PHYSICAL ANALYSIS. Contract AF33(616)-2315.

A Quantometric Point-to-Plane method of emission spectrographic analysis has been developed which is capable of giving accurate results, with reasonable speed, on solid samples of Ti alloys, which show segregation. A vapor Injection Solution technique for the spectrographic analyses of Ti alloy solutions gives excellent precision, with accuracy and speed. (F.S.)

8738

QUADRUPOLAR SPLITTING OF THE Al^{27} AND Be^9 MAGNETIC RESONANCES IN BERYL CRYSTALS. L. Carlton Brown and Dudley Williams (Ohio State Univ., Columbus). J. Chem. Phys. 24, 751-6(1956) Apr.

The quadrupolar hyperfine structure of the Al^{27} and Be^9 nuclear magnetic resonance peaks in beryl crystal at 300°K have been examined. From the observed spectra, values were obtained for the nuclear spins I, the effective nuclear magnetic moments μ, the nuclear quadrupole coupling constants $eQ\varphi_{zz}$, and the electric field asymmetry parameters η. (auth)

8739

INFRARED SPECTRUM OF PF_5. J. Paul Pensler and W. G. Planet, Jr. (Goodyear Atomic Corp., Portsmouth, Ohio). J. Chem. Phys. 24, 920-1(1956) Apr.

8740

CORRELATION OF SYMMETRICAL VIBRATION FREQUENCIES. Harold T. Hahn (Hanford Atomic Products Operation, Richland, Wash.). J. Chem. Phys. 24, 921(1956) Apr.

Partition function ratios were estimated for several compounds and radicals from assigned symmetrical vibration frequencies. The values for oxygen bonding are highest, and for other classes decrease in the order: oxides> fluorides> bromides≥ chlorides. (C.W.H.)

8741

NORMAL VIBRATION FREQUENCIES OF CD_3F. STRUCTURE OF CH_3F AND CD_3F FROM INFRARED AND MICROWAVE SPECTRA. F. Allan Andersen, Bφrge Bak, and Svend Brodersen (Univ. of Copenhagen, Denmark). J. Chem. Phys. 24, 989-92(1956) May.

The infrared absorption spectrum of CD_3F has been studied. Simultaneously, the infrared spectrum of CH_3F was reinvestigated. Fundamental vibration frequencies for CD_3F were found together with Coriolis coupling factors for the three degenerate vibrations in CH_3F and CD_3F. The fine-structure analysis gave reliable values for the large rotational constants of CD_3F and CH_3F. The structure of the methyl fluoride molecule is discussed. (auth)

8742

INFRARED ABSORPTION INTENSITIES AND BOND MOMENTS IN BF_3 AND RELATED MOLECULES. D. C. McKean (Brown Univ., Providence, R. I.). J. Chem. Phys. 24, 1002-6(1956) May.

The infrared absorption intensities of the fundamental vibration bands of BF_3 have been measured and vibrational bond moments μ and their derivatives $\partial\mu/\partial r$ determined. In the A_2'' class, $\mu_{BF} = 1.7$ D; in the E' class $\mu_{BF} = 0.9$ or 2.6 D, $\partial\mu/\partial r = -6.1$ or + 4.0 D/A. Inspection of the form of the bending modes suggests that deviations from the bond

moment approximation occur such that $\mu(A_2'') < \mu(\text{static}) < \mu(E')$. The solution $\mu(E') = 2.6$ D is therefore preferred. Re-examination of the data of Schatz and Hornig on CF_4, SiF_4, and SF_6 in the light of the present results shows that the vibrational bond moments in these molecules are: $\mu_{CF} \sim 2.4$, $\mu_{SiF} \sim 3.3$, $\mu_{SF} \sim 2.7$ D. These moments are roughly equal to Δr_0, where r_0 is the bond length and Δ the electronegativity difference between the atoms in the bond. The available data on μ and $\partial\mu/\partial r$ for the C–F bond in various molecules are compared and briefly discussed. (auth)

8743

PROTON MAGNETIC RESONANCE OF HYDROCARBONS. J. A. Pople (Univ. of Cambridge, England). J. Chem. Phys. 24, 1111(1956) May.

8744

THE PREPARATION AND USE OF ADDITIVELY COLOURED ALKALI HALIDE CRYSTALS AS INFRARED TRANSMISSION FILTERS. W. G. Burns and J. Gaunt. pp.66-73 of "MOLECULAR SPECTROSCOPY. REPORT OF A CONFERENCE ORGANIZED BY THE SPECTROSCOPIC PANEL OF THE HYDROCARBON RESEARCH GROUP OF THE INSTITUTE OF PETROLEUM AND HELD IN LONDON – OCTOBER 28-29, 1954." George Sell, ed. London, Institute of Petroleum, 1955.

Crystals containing high concentrations of F-centers, made by heating alkali halides with K and cooling them quickly have already been shown to have suitable characteristics for use as near infrared transmission filters. The effect of controlling the cooling of such crystals has been studied, and it has been shown possible to vary the infrared transmission from a sharp cut-in at about 1.2 μ to a slow increase in transmission starting at 10 to 15 μ, caused by very slow cooling. The extension of the visible absorption into the infrared is accompanied by a decrease in the sharpness of the transmission edge. The outer layer of the crystal has also been shown to have a great effect in extending the infrared absorption. Work on very thin sections has shown that in the center of the crystal the effect of slow cooling is to cause the formation of R,M, and N centers, but at the edge the colloidal band predominates. The use of such additively colored alkali halide crystals as infrared transmission filters is demonstrated and discussed. (auth)

8745

A MAGNETIC SPECTROMETER. D. J. Prowse (Univ. of Bristol, England) and W. M. Gibson (Queen's Univ. of Belfast). J. Sci. Instr. 33, 129-32(1956) Apr.

A little-known type of magnetic spectrometer, for measuring the energy of heavy charged particles, is described. The principle is due to P. H. Fowler; the source is outside the region of magnetic field, which particles enter and leave across a straight boundary; particles of different energies are brought to second-order foci at points along a line which also lies outside the region of magnetic field. The principles and the factors limiting the resolution are discussed briefly. The design and performance of an instrument built for protons of energy up to 8 Mev are described; a resolution of up to 1 in 800 in momentum has been obtained. (auth)

8746

ISOTOPE SPECTRAL ANALYSIS. A. R. Stziganov. Uspekhi Fiz. Nauk 58, 365-414(1956) Mar. (In Russian)

Methods of isotope spectral analysis of emission spectra, spectral line structures, heavy water, lithium, uranium and gaseous mixtures of hydrogen, and deuterium as well as other applications of isotope spectral analysis are reviewed. (R.V.J.)

Refer also to abstracts 8257 and 8278.

THEORETICAL PHYSICS

8747 NP-6061

California. Univ., Berkeley.

NUCLEON ENERGY LEVELS IN A VELOCITY DEPENDENT POTENTIAL (thesis). Technical Report No. 6. A. A. Ross, R. D. Lawson, and Hans Mark. [1956]. 35p. Contract DA-04-200-ord-171.

The neutron and proton level sequences in a diffuse, velocity dependent potential have been investigated. A velocity dependent interaction is used which manifests itself by attributing to a nucleon inside nuclear matter an 'effective mass' which is a function of its position. Following Brueckner, Johnson and Teller, and Duerr, the effective mass in the center of the nucleus is chosen to be one-half the free particle mass. The potential form was taken as $V(r) = V_0/1 + \exp\alpha(r-\alpha)$ and for protons a Coulomb potential derived from a uniform charge distribution reaching to r = a was added. The proper neutron shell structure and level sequence was obtained with the parameters $\alpha = 1.16 \times 10^{13}\text{cm}^{-1}$, $a = 1.3A^{\frac{1}{3}} \times 10^{-13}$cm, $V_0 = 69$ Mev, and a spin-orbit coupling 33 times the Thomas term. For protons, using the same α, radius, and spin-orbit coupling, it was found that the potential depth had to be increased by roughly 13 Mev to bind the correct number of protons in Pb^{208}. If Pauli principle correlations are included then a deeper proton potential is obtained. This correction depends critically on the form of the nucleon densities. Since a self-consistent treatment has not been made, this effect has been estimated in two ways: 1) A Fermi-Thomas approximation was used to compute the densities. In this case, the correct neutron-proton ratio is obtained but the correct proton level sequence is destroyed. 2) The neutron well depth was increased by an amount $(N + Z/2)/(Z + N/2)$. In this approximation the correct proton level sequence is obtained but it is not possible to bind the proper number of protons. (auth)

8748

TRANSFER OF NUCLEAR PARTICLES. G. Breit (Yale Univ., New Haven, Conn.). Phys. Rev. 102, 549-56(1956) Apr. 15.

The calculation of the wave function of a particle subjected to the field of two isolated potential wells is arranged in such a way as to bring into evidence the penetration factors for passage through regions of negative kinetic energy between the wells. The Schrödinger equation is replaced by an equivalent integral equation, and the eigenfunction system of the latter is used for the expansion of the wave function. The dependence of the kernel on energy and the transformation from the reference system of the integral equation to that of the wave equation are considered. Extensions to three-dimensional problems and to many nuclear particles are discussed and some characteristic differences from the one-dimensional case are pointed out. The presence of more than one tunnelling factor in the general case and the participation of tongues or tentacles in configuration space which correspond to the temporary formation of nuclear aggregates such as deuterons or alpha particles are considered. (auth)

8749

SYNTHESIS OF COVARIANT PARTICLE EQUATIONS. Leslie L. Foldy (Case Inst. of Tech., Cleveland, Ohio). Phys. Rev. 102, 568-81(1956) Apr. 15.

By combining two irreducible representations of the proper inhomogeneous Lorentz group, certain irreducible unitary representations of the complete Lorentz group including space and time inversion are obtained, together with a Schrödinger equation whose solutions constitute the representation space for these representations. The representations thus define a "canonical" form for covariant particle

theories, in which not only the wave equations but the manner in which the wave functions transform under Lorentz transformations is prescribed. It is shown that by a suitable choice of representation, the Dirac, Klein-Gordon, and Proca equations can all be reduced to this canonical form. It is further shown that in the representation space provided, several possibilities exist for the identification of the transformations to be associated with space inversion, time inversion, and charge conjugation, thus suggesting the existence of several distinct relativistic theories for particles of any given spin. Conjectures are made as to the physical significance of these different possibilities when the equations are second-quantized. It is shown that each of the conventional theories employs only one of the available possibilities for these transformations, the choices being different for integral and half-integral spin theories. (auth)

8750

NEUTRON-PROTON POTENTIAL AND THERMAL NEUTRON CAPTURE BY PROTONS. Khosrow Chadan. Compt. rend. 242, 1964-6(1956) Apr. 16. (In French)

8751

CLASSICAL MESON THEORY. II. S. Kahana and H. R. Coish (Univ. of Manitoba, Winnipeg, Canada). Am. J. Phys. 24, 390-9(1956) May.

Classical meson theory, to which an elementary introduction is given in part I, is applied to nuclear forces, the deuteron, meson scattering, and photoproduction. (auth)

8752

ON TRANSFORMATIONS IN RELATIVISTIC MECHANICS. R. K. Pathria (Univ. of Delhi, India). Am. J. Phys. 24, 411-13(1956) May.

The use of hyperbolic functions to simplify various transformations in the theory of relativity is briefly discussed. (B.J.H.)

8753

STRUCTURE OF THE MASS INCREMENTS OF ISOTOPES. G. A. Baker, Jr. and G. A. Baker, Sr. (Univ. of California, Berkeley and Davis). Can. J. Phys. 34, 423-31(1956) May.

A simple, accurate formula for the atomic masses of all isotopes is developed on the basis of a simplified nuclear model. It is shown theoretically and empirically that a formula which is linear in A and whose coefficients depend only on N−Z with a term added for pairing effects accounts for the major portion of the structure in the present experimental data and predicts them with unexcelled accuracy. (auth)

TRACER APPLICATIONS

8754

RADIOACTIVE ISOTOPE STUDY OF THE DISSOCIATION OF BARIUM OXIDE UNDER ELECTRON BOMBARDMENT. S. Yoshida, N. Shibata, Y. Igarashi, and H. Arata (Nippon Telegraph and Telephone Corp., Tokyo, Japan). J. Appl. Phys. 28, 497-500(1956) May.

The evolution of Ba from BaO was detected by using radioactive Ba^{140}, and the rate was measured for various electron bombardment conditions. The following results were obtained: (1) When the bombarding voltage was fixed, the rate of evolution increased linearly with the number of primary electrons, provided the temperature of the oxide remained constant. (2) The rate of evolution increased exponentially with temperature; the activation energy was about 0.7 ev. (3) The efficiency of 500 ev electrons was far less than of 150 ev electrons at constant bombarding power. (4) The efficiency was around 3.9×10^{-7} atom per primary electron at 150 ev and 710°K. A simple mechanism of the electron bombardment dissociation is proposed. (auth)

Refer also to abstract 8252.

URANIUM AND URANIUM COMPOUNDS

8755 IDO-16296

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CRITICALITY OF UNREFLECTED, INFINITELY-LONG CYLINDERS OF URANYL NITRATE SOLUTION. J. W. Webster, G. A. Cazier, and M. A. Wahlgren. Oct. 13, 1955. Decl. June 4, 1956. 4p. Contract AT(10-1)-205. (PTR-8\ $1.80(ph OTS); $1.80(mf OTS).

8756

PARAMAGNETIC RESONANCE ABSORPTION IN URANIUM (III) CHLORIDE AND THE NUCLEAR SPIN OF URANIUM-235. Clyde A. Hutchison, Jr., P. M. Llewellyn, Eugene Wong, and Paul Dorain (Clarendon Lab., Oxford, England and Enrico Fermi Inst. for Nuclear Studies and Dept. of Chemistry, Univ. of Chicago). Phys. Rev. 102, 292(1956) Apr. 1.

Observations were made of resonance absorption in single crystals of anhydrous UCl_3 diluted with $LaCl_3$. (B.J.H.)